FACTORY

BETTER PRODUCTION AND MAINTENANCE THROUGH BETTER MANAGEMENT

FEBRUARY 1959

PRICE ONE DOLLAR

A McGRAW-HILL PUBLICATION

MAINTENANCE COST GUIDE . . p. 72

How industry spends $14-billion a year

LATEST WAY TO MEASURE MANAGERS . . . . . p. 62

NEW JOB-SHOP HELP — POINT-OF-USE STORAGE . . . . . p. 144

Maintenance–Saving Features You Can See

LUNKENHEIMER IRON BODY GATE VALVES

Machined guides . . . another Lunkenheimer exclusive, eliminate chatter and reduce wear . . . *true-solid discs* are unaffected by temperature variations . . . *Stemalloy® stems* assure longer stem thread life . . . *seat rings do not come loose or distort*—these are a few of the features that make Lunkenheimer Iron Body Gate Valves the most maintenance-free in the industry.

Ask your Lunkenheimer Distributor for a comparison test that will save you maintenance dollars, or write The Lunkenheimer Company, Cincinnati 14, Ohio.

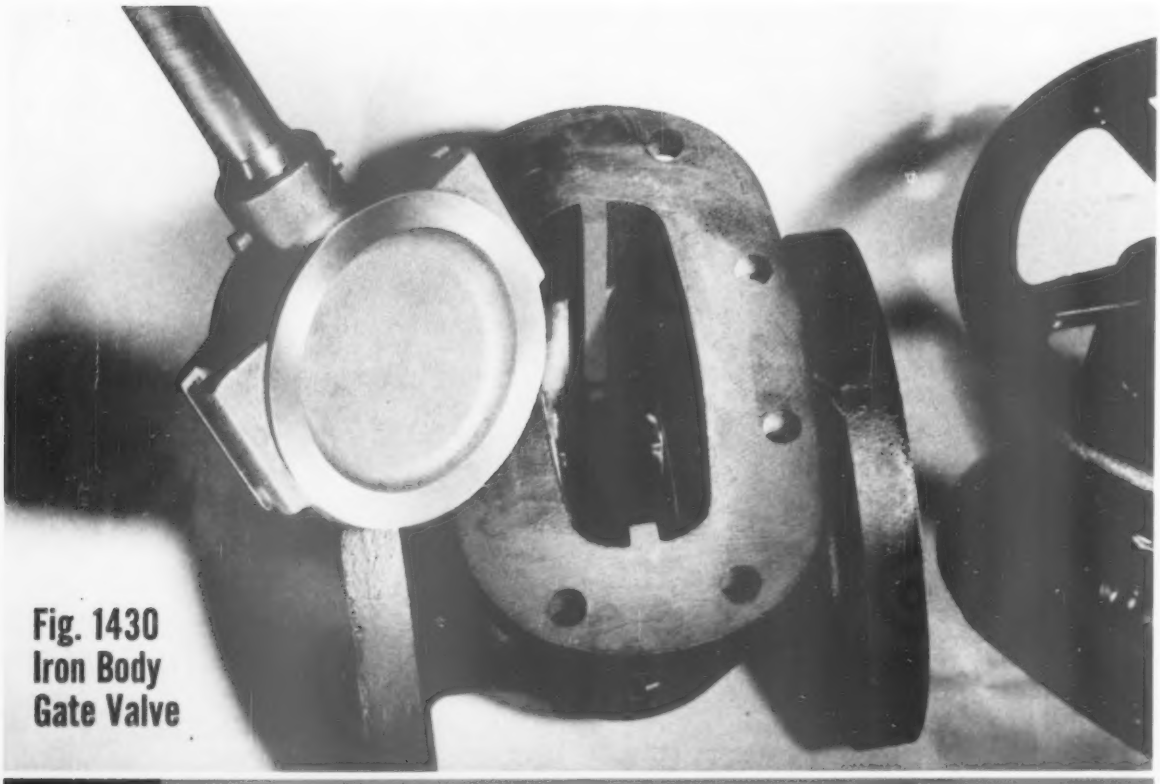


Fig. 1430
Iron Body
Gate Valve

LUNKENHEIMER
QUALITY

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

L-258-26

For more facts circle 446 on READER SERVICE CARD

B.F.Goodrich

SUCCESS STORIES

B.F.Goodrich distributors helped these customers cut costs. Can they help you?

Magnetic Attraction

At the steel plant in the picture, wire from big coils goes into a machine that forms it into nails and spits them out against a rubber belt with magnets behind it. Up the nails go and into a cart to be wheeled away. But when ordinary belting was used, the nails used to slip and slide; the belts were short-lived.

Then a B.F.Goodrich distributor sold the company B.F.Goodrich oil-resisting Griptite belts. Parallel ribs of flexible rubber, spaced four to the inch, give this belt good gripping action.

Now the nails stick to the belts much better. Each Griptite belt lasts about a year—four or five times as long as former belts lasted.

Shakedown treatment

An Alabama coal mine uses big metal tables to separate the rock that gets mined with coal. Coal and water are dumped on these tables, which jiggle constantly, literally shaking the rock out of the coal. But the sharp rock and coal wore out every material used to cover the tables. Some covers lasted only two months.

When a B.F.Goodrich distributor heard about this, he told the coal company about B.F.Goodrich "Armorite", a rubber so tough it often outlasts the hardest steel 10 to 1. One of the coal-shaking tables was covered with this rubber. It lasted 10 years, handled 1,841,190 tons. Because of the big savings in repairs and replacements, the company has had all their coal-separating tables covered with Armorite.

Duct soup

A manufacturer of photographic equipment in New York state bought a test section of fume duct 6 feet by 6 feet by 4 feet, made of B.F.Goodrich rigid Koroseal material. Koroseal, often made in flexible forms, can be made rigid, resists most acids and chemicals. The distributor has now received approval of the test and authority to proceed with a system which will cost about $7,000.

Good riddance

A steel company used to have trouble piping huge quantities of fly ash to a disposal pit. The mixture of acid water, gritty fly ash and metal slivers was wearing holes through metal pipe in only six months. Each pipe replacement cost $700 plus about 100 hours of workers' time.

Company engineers, working with a B.F.Goodrich distributor, decided to replace the pipe with a B.F.Goodrich hose designed to handle rough materials. After 8 years' service, the B.F.Goodrich hose, called "Convertapipe", shows no sign of wear, looks good for years more use. Plant engineers figure the change from pipe to rubber hose has already saved $6,400 in replacement costs and $4,800 in maintenance costs.

Hot foot

A manufacturer of house-trailer steps in Arizona had trouble with ordinary rubber stair treads in the hot Arizona climate. Aluminum sheets on the vertical panels of steps reflected and concentrated the sun's rays on the horizontal rubber parts, making the temperature 140 to 170 degrees.

Then Koroseal runner matting was recommended by a B.F.Goodrich distributor. Customer finds it stands the sun better, has long life, is oil-resisting, easy to clean, does not creep.

Chain reaction

A B.F.Goodrich distributor in Massachusetts sold large-size V belts to a food processor by redesigning a high-cost chain-type conveyor carrying trays. The rubber belts work better than the chain, save money for the customer.

New product

Industrial fire hose. B.F.Goodrich "Imperial" hose, made with an all-Dacron jacket, is recommended for heavy-duty service in oil refineries, chemical plants, construction jobs, mining, and in general industrial service. Hose is lighter, more flexible, stronger, longer-lasting than conventional industrial fire hose; has exceptional resistance to abrasion, is impervious to mildew, oil, acids, alcohols, hydrocarbons and detergents. Sizes: 1″, 1½″, 2″, 2½″.

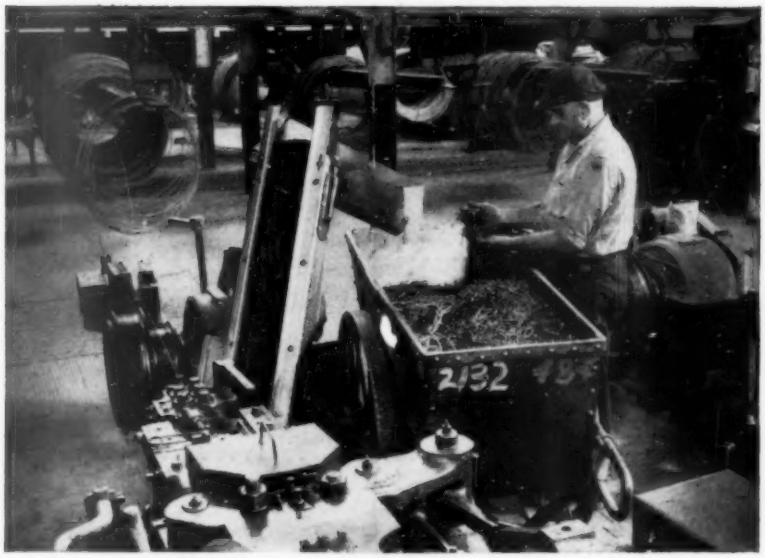
New catalog

Oil-resisting conveyor belts. Catalog No. 2460 tells how to select B.F.Goodrich oil-resisting conveyor belts. Performance of three types of belting—oil-resisting, oilproof and superoilproof—is compared in services where belts are subjected to petroleum oils, cutting oils, organic solvents, cleaners, lacquer solvents and fatty oils.

For more information

For full information about any product described on this page, see your B.F.Goodrich distributor or write *B.F.Goodrich Industrial Products Co., Dept. M-514, Akron 18, Ohio.*

Koroseal—T. M. Reg. U. S. Pat. Off.



Nails fall up, costs go down—see "Magnetic attraction"

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industrial
rubber products

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CONTENTS FEBRUARY 1959

Cover—Original Kent Day Coes watercolor painting of Amerock Corporation's colorful, expandable plant at Rockford, Ill.

Letters 8

Press Time Report ..... *after* 54
Looking Ahead in Business, Ideas of the Month, Maintenance Cost Index, Looking Ahead in Labor

Opinion 61

*Better Way to Measure Your Managers (FC-25) 62

*43 Ways to Use Your Drillpress (FC-26) 68

What Industry Is Spending for Maintenance 72

Now—a More Exact Cost Index 79

Solving Your Plant Problems by Simulation 80

What You Should Know About Managers' Tensions .. 86

Equipment News 88

CASE BOOK for Plant Operating Management 113
16 idea-packed pages—see contents, page 114

*New Job-Shop Trend: Point-of-Use Storage (FC-27) .. 144

Ideas of the Month 164

Human Relations 168

Books 170

Films 177

Labor Relations News 182

Measuring Hard-to-Measure Jobs 192

Catalog News 200

Materials News 211

Measuring Maintenance Output 220

Coming Up Fast: Static Switching 232

Advertisers' Literature 248

*For your free file copy of this article, circle appropriate number (parentheses above) on Reader Service Card, next to back cover.

THE MAGAZINE OF PLANT OPERATING MANAGEMENT

Edited exclusively for the men with management responsibilty for production and maintenance in the manufacturing industries

PROBLEM-SOLVING GUIDE

THIS SIMPLE FILING SYSTEM is designed to give quick access to past FACTORY articles that can help you solve current operating problems. Here's how it works:

1. All major articles and many short items are classified according to a functional code system (below). Codes cover basic operating responsibilities.

2. Where applicable, articles are also coded (see numbers in parentheses) to show secondary or closely related topics.

3. To use, cut up the items below. Paste them on 3x5-in. cards and file by code number. To cross-index, copy the information on a second card, and file by secondary code.

Note: For suggestions on using this new tool (plus an outline for a more complete decimal filing system), see FACTORY, February 1957, page 104.

BASIC INDEXING CODE

1.0 Plant Engineering	2.0 Production	3.0 Plant Management
1.1 Management and Practices	2.1 Management	3.1 Organization and Policies
1.2 Buildings and Yards	2.2 Production Controls and Systems	3.2 Personnel Development
1.3 Services and Facilities	2.3 Methods and Technology	3.3 Employee Relations
1.4 Electrical Services	2.4 Materials Handling and Plant Layout	3.4 Labor Costs

1.1 What Industry Is Spending for Maintenance
Feb. '59, p. 72

1.1 Silences Noisy Foundry Shrieks
Feb. '59, p. 117

1.1 Measuring Maintenance Output
Feb. '59, p. 220

1.2 It's Not a Stairway to the Stars
Feb. '59, p. 117

1.2 Repairs Don't Stop Production
Feb. '59, p. 126

1.3 Gets Rid of Unwelcome Impurities Completely
Feb. '59, p. 116

1.3 Down With Those Clean-Up Costs
Feb. '59, p. 128

1.4 Puts Switches in Open View
Feb. '59, p. 120

1.4 Motor Juggling Saves the Day
Feb. '59, p. 120

1.4 Newest Phone Dialing System
Feb. '59, p. 122

1.4 Gets Materials in Faster (2.4)
Feb. '59, p. 125

1.4 Ten Cameras Watch 43 Truck Docks (2.4)
Feb. '59, p. 126

1.4 Coming Up Fast: Static Switching (1.3)
Feb. '59, p. 232

2.2 Shuffled Lineup Smooths Operation
Feb. '59, p. 122

2.2 What Effects From Incentive Pay?
Feb. '59, p. 124

2.2 Measuring Hard-to-Measure Jobs
Feb. '59, p. 192

2.3 43 Ways to Use Your Drillpress
Feb. '59, p. 68

2.3 Vertical Ovens Cut Drying Costs
Feb. '59, p. 118

2.3 Cuts Steel Like Butter
Feb. '59, p. 118

2.3 Little Tricks Make Operation Smoother (2.4)
Feb. '59, p. 119

2.3 New Salvage Idea Speeds Tooling
Feb. '59, p. 120

2.3 Makes Boat Building Look Easy
Feb. '59, p. 121

2.3 One Man Now Replaces Three
Feb. '59, p. 122

2.3 Tailored Tools Tame Tough Tasks
Feb. '59, p. 123

2.4 Makes Layout Planning Easier
Feb. '59, p. 114

2.4 High Level, High Speed Storage
Feb. '59, p. 115

2.4 Paper Separators Cut Warehouse Cost
Feb. '59, p. 122

2.4 Special Conveyor Speeds Assembly
Feb. '59, p. 124

2.4 Rack Saves Air Space and Packers' Time
Feb. '59, p. 126

2.4 Here's Really Automatic Handling
Feb. '59, p. 127

2.4 Floats the Jigs Right Into Place
Feb. '59, p. 128

2.4 New Job-Shop Trend: Point-of-Use Storage
Feb. '59, p. 144

3.1 Better Way to Measure Your Managers (3.2)
Feb. '59, p. 62

3.1 Solving Your Plant Problems by Simulation
Feb. '59, p. 80 (2.1)

3.1 Manual Tells Best Way to Ship
Feb. '59, p. 116

3.1 Company Makes Good Credit Union Loss
Feb. '59, p. 126

3.1 Clerk Sorts Mail as Truck Rolls
Feb. '59, p. 128

3.1 More Automation or Else (3.2)
Feb. '59, p. 168

3.2 What You Should Know About Managers' Tensions
Feb. '59, p. 86 (3.3)

3.2 Tips on Placing Handicapped Workers (3.3)
Feb. '59, p. 115

3.2 Better Check Your Hiring Performance
Feb. '59, p. 116

3.2 Leisurely Idea Man
Feb. '59, p. 169

3.2 Fast-Moving Managers
Feb. '59, p. 169

3.3 Suggesters Win Company Stock
Feb. '59, p. 118

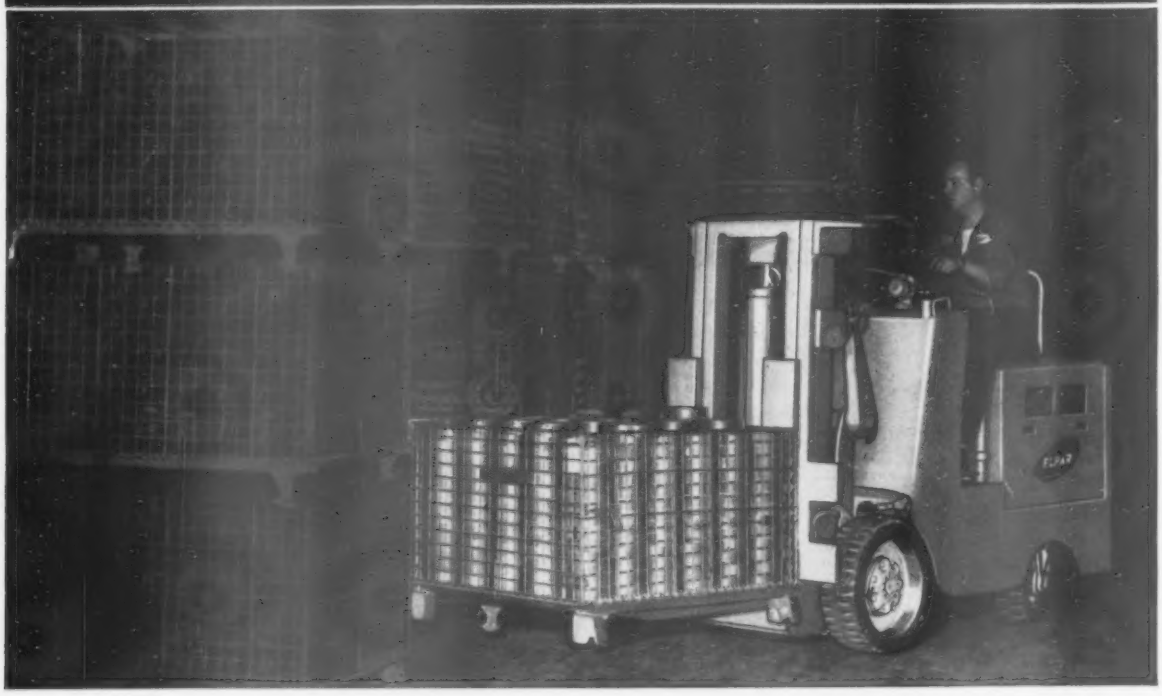
3.3 Older Workers Find Jobs
Feb. '59, p. 168

3.3 Young Artist, Happy Papa
Feb. '59, p. 168

3.3 Taking the Offensive
Feb. '59, p. 169

3.4 New Shipping Pack Cuts Damage
Feb. '59, p. 118

ELPAR ELECTRIC TRUCKS...



Save $1,200 Per Truck Per Year

Cost surveys at a number of plants reveal that ELPAR electric truck operating and maintenance costs are only *one-third* those of comparable models in other power types. Based on 2,000 hours of operation, this means an average saving of more than $1,200 per truck per year.

In addition, ELPAR electrics give twice as many years of dependable service as gas trucks operating under similar conditions. Thus, when *all* initial and replacement costs are added up, ELPAR electric trucks actually cost *less* to buy.

And, the surveys show that average downtime for ELPAR electrics is 2 to 3% while that for gas trucks is 10 to 15%.

More and more companies are converting their fleets to dependable, fume-free ELPAR trucks. Join the trend. Choose from our complete line of fork and ram trucks, low lift and high lift platform trucks, and mobile cranes—and save on *first* cost and *operating* cost. Get all the facts...

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of the ELPAR *Lift*, "Gas vs. Electric Trucks" and "LP-Gas vs. Electric Trucks." Also, send for Condensed General Catalog.

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Twice the Life...1/3rd the Operating Costs

For more facts Circle 450 on Reader Service Card

Held down "impossible" job for months vs. days

They were asking the "impossible" at this big West Coast mine. The hose used in their big beneficiation plant must be tough enough to handle the flow of murderously abrasive iron-ore slurry. Yet it still must be flexible enough to follow a twisting, bending course down from the top of the seven-story structure.

So it's little wonder their first hose sprang numerous leaks almost immediately—was finished completely in about 45 days. It wasn't until the G.T.M. – Goodyear Technical Man—recommended his special ore-carrying hose that they got satisfactory service.

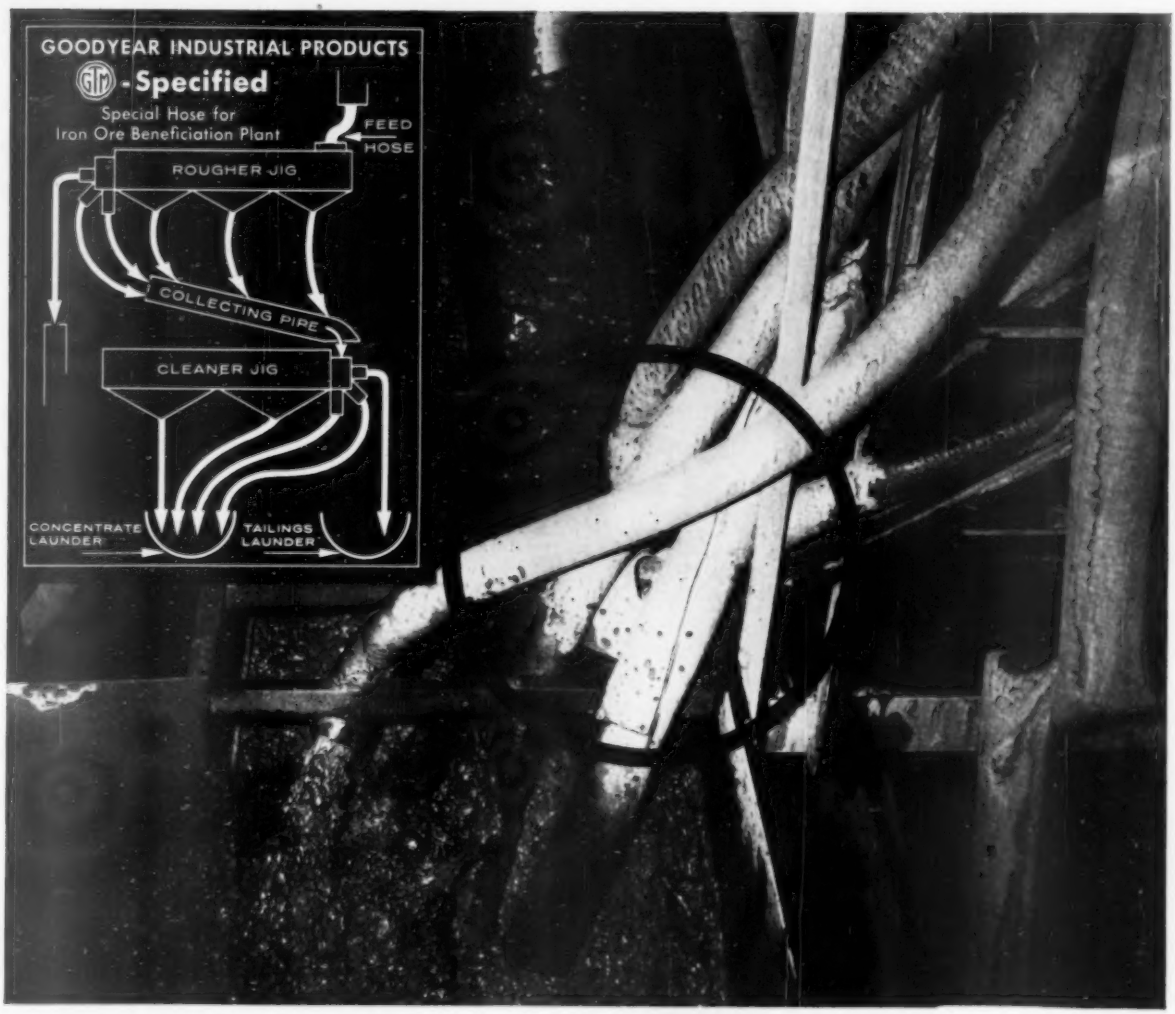
In fact, the G.T.M.'s hose has been so successful that the company's purchased over 4,000 feet of it to date.

It's been on the job over 12 months now – completely mastering this extra-tough job.

So once again, the G.T.M. has proved that the "impossible" often boils down to right hose – and the right recommendation. Make sure you get both–by contacting your Goodyear Distributor – or writing Goodyear, Industrial Products Division, Akron 16, Ohio.

• • •

IT'S SMART TO DO BUSINESS *with your Goodyear Distributor. He can give you fast, dependable service on V-Belts, Hose, Flat Belts and many other industrial rubber and non-rubber supplies. Look for him in the Yellow Pages under "Rubber Goods" or "Rubber Products."*

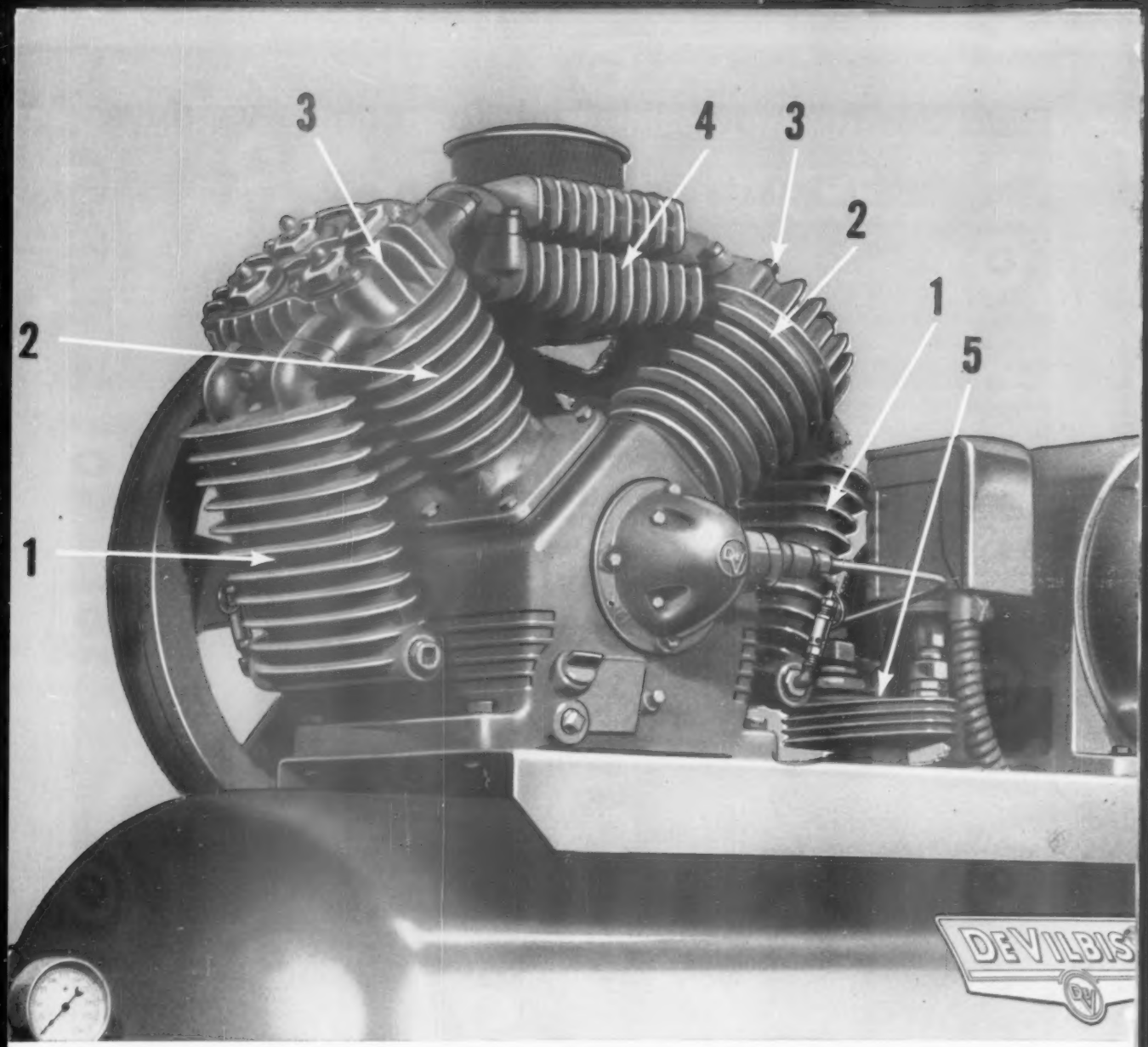


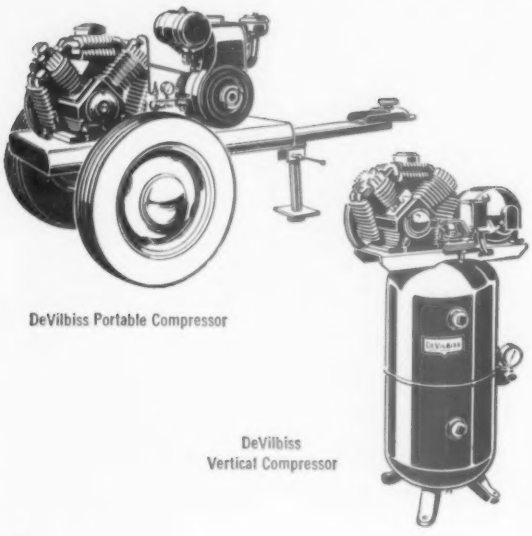
HOSE FOR ALL INDUSTRY BY

GOODYEAR

THE GREATEST NAME IN RUBBER

For more facts Circle 451 on Reader Service Card





DeVilbiss Portable Compressor

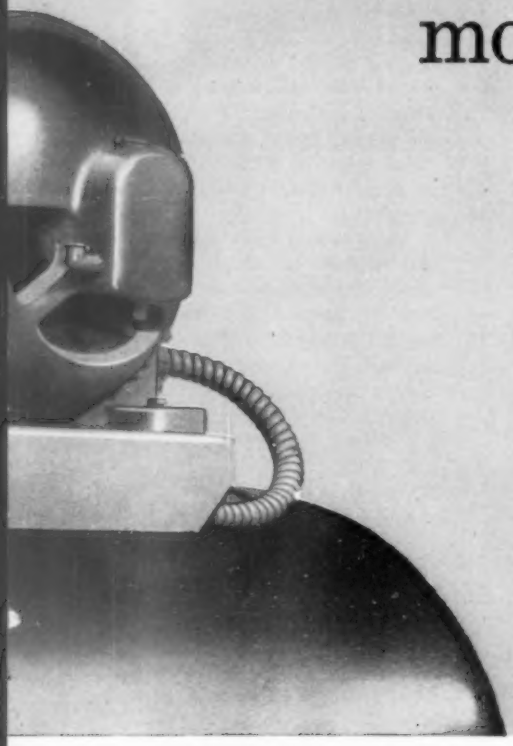
DeVilbiss
Vertical Compressor

THE cooling system of a compressor makes a big difference in operating efficiency. The hotter the air delivered into the tank, the greater the shrinkage when it cools. But a cool-running compressor delivers low-temperature, less-expanded air to the tank, resulting in fewer running cycles for any given air demand.

DeVilbiss compressors with their greater finned cooling area deliver air to the tank at lower temperature. Result: less air shrinkage in the tank, less frequent running cycles, longer service with lower power consumption.

Compare for yourself. Notice the finned, cast-iron

More finned cooling area makes DeVilbiss compressors more efficient



1. **Finned Intercoolers**
2. **Finned Cylinder Walls**
3. **Finned Cylinder Heads**
4. **Finned Aftercooler**
5. **Finned Check-Valve Manifold**

intercoolers (1), with large-capacity chambers which retard the velocity of the air to permit a longer cooling cycle between compressing stages. The deeply finned cylinder walls (2) and heads (3), designed for rapid and thorough heat dissipation. The finned aftercooler (4), that lowers the temperature further before air enters the tank. Even the check-valve manifold (5) at the tank is finned for maximum aftercooling.

More finned cooling area is only one of the greater efficiency features of DeVilbiss air compressors. Send for Catalog C-50, or call the local DeVilbiss representative for all the facts.

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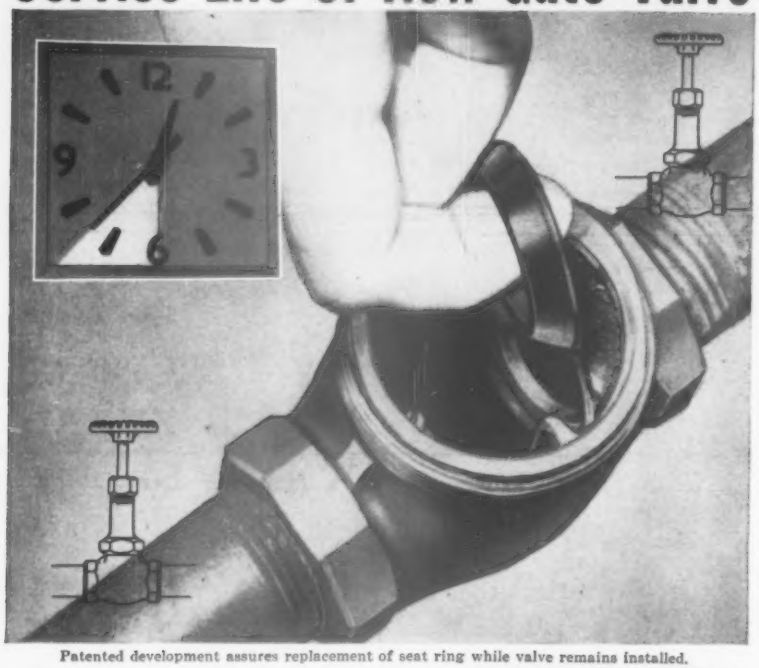
Only 7 to 10 Minutes to Renew Service Life of New Gate Valve



Patented development assures replacement of seat ring while valve remains installed.

Without removing the valve body from the line, you replace the nickel-alloy seat rings in Fairbanks new patented Renewable Seat Ring Gate Valves. In 7 to 10 minutes, from the time the line is shut down until it is put back into operation, you have given a new service life, a new life of dependable tight closure to your valve.

Just 7 to 10 minutes of your maintenance man's time — only 7 to 10 minutes of "down-time" on your steam, water or process piping lines — and you have the equivalent of a new valve in the line. Think of the savings: where once at least one hour, under the most ideal conditions, was required to replace a gate valve in the line, the job is now accomplished in from 7 to 10 minutes.

Field tested for over two years, under all conditions from steam to corrosive liquids, the revolutionary new Fairbanks Renewable Seat Ring Bronze Gate Valve has proven completely satisfactory — absolutely dependable.

Made with either rising stem or non-rising stem construction in ½",¾",1", 1¼", 1½" and 2" sizes, the Fairbanks Renewable Seat Ring Bronze Gate Valves are recommended for severe service conditions on 200 lb. steam pressure at 550 degrees F., 400 lb. water, oil or gas pressure — non-shock — lines requiring full flow and subject to frequent operation. Nickel alloy seat rings and wedge make the valves particularly tough and corrosion resistant.

YOURS ON REQUEST: Illustrated, descriptive folder gives complete information on Fairbanks Renewable Seat Ring Gate Valve with details and specifications. Yours without charge. Write today.

1. Union Bonnet removed. Retaining screw loosened with ordinary screwdriver.

2. Finger hooks inside nickel alloy seat ring. Seat ring lifts out of valve body.

3. New seat ring is inserted. Retaining screw tightened. Bonnet replaced.

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FACTORY LETTERS

TOUGH MEASURE

Sir:

I've been very much interested in reading "Rate of Return—Toughest Measure for a Manager" (FACTORY, Nov. 1958, p. 90) by Lloyd Smiley.

I have read the article with considerable interest but it has left me confused. Is it possible to obtain the very basic data on which this hypothetical case is based? What is needed is the original cost, estimated life, and estimated salvage value of each machine together with the present age of the new machine. Also there is needed the detailed analysis of fixed and variable operating costs.

In particular I am confused about the manner in which Mr. Smiley treats depreciation cost. In method one, the accounting method, annual savings is given as $8400, then as savings less income tax as $4200, then as savings less income tax and depreciation as $3300.

This is also done in method two, the pay-back method. Then on page 97 under plan five (the investor's method) the first column states "Profit before depreciation."

It seems to me that there is an inconsistency here. Two definitions of savings are given and used:

1. Savings or earnings after all costs are taken care of, or differential operating costs;

2. Savings or earnings before depreciation.

Turn the page

FACTORY

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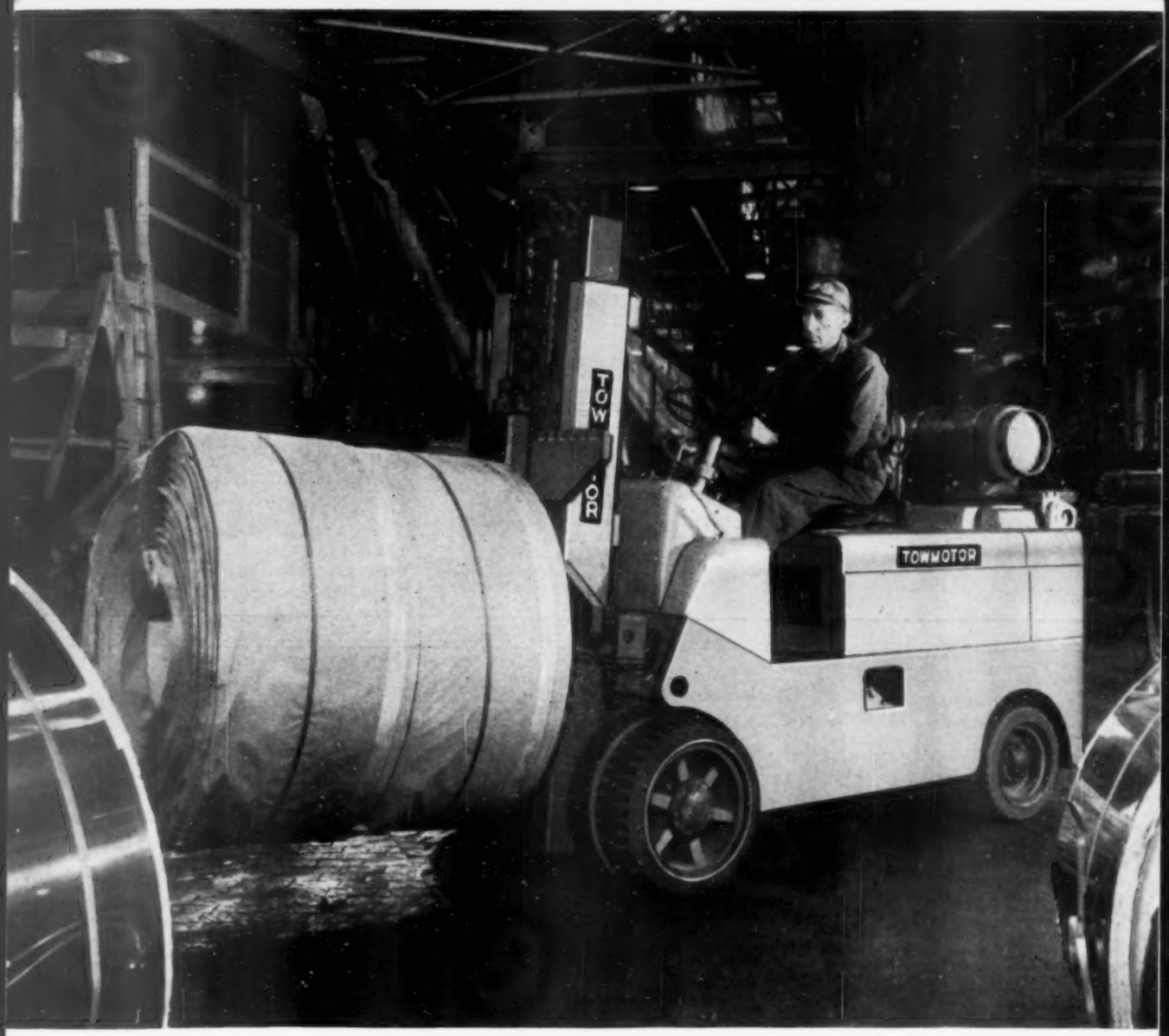

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Of all fork lift trucks, *this Towmotor Pace-Maker has it!* Mass-handling miracles seem to happen every minute it's on the job. Its hydraulic muscles hustle heavy loads through storage, production and shipping with a real promise of extra profits *around the calendar.*

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TOWMOTOR ® -GERLINGER

THE ONE-MAN-GANG

Gerlinger Carrier Co. is a subsidiary of Towmotor Corporation

For more facts Circle 454 on Reader Service Card

"KEX" Industrial Towel
Rental Service helps cut costs
at AiResearch

Modern plants use the modern way to handle wiping material requirements—through "KEX", the Industrial Towel Service that cuts costs, boosts efficiency.

Endorsed by the Garrett Corporation AiResearch Manufacturing Division in Los Angeles, the "KEX" Service System, through proper installation and control, has provided the most efficient and effective means of handling wiping material requirements at this plant. "KEX" can do the same for you.

AiResearch is serviced by Prudential Overall Supply of Los Angeles, one of the independent, franchised distributors available through the "KEX" nation-wide service.

See "Wiping Cloths" or write to "KEX" National Service, 295 Fifth Avenue, New York 16, N. Y.

"KEX" NATIONAL SERVICE
REG. U.S. PAT. OFF.

It isn't "KEX" unless it's imprinted with the "KEX" name.

For more facts Circle 455 on Reader Service Card

In order for me to evaluate this article and use it for my classes I need the basic information stated above and I would also like an explanation as to the definition of savings or earnings. Depreciation has always been an item of cost even in accounting, so I am confused as to the use in this paper.

C. E. Bullinger
Professor of Industrial Engineering
Iowa State College, Ames, Iowa

► We don't have more data than are supplied in this article, but anyone can compile additional data. This can be done readily by using Editor Carl Wyder's "Cost Comparisons You Can Trust," p. 156, FACTORY's November issue.

We believe we can see what you are driving at when you ask for the original cost, estimated life, and salvage value of each machine. You want to determine the cost of using present equipment as against the cost of using the proposed equipment. If the old machine were not written off, this would have been done. The article assumes that the old machine has been amortized but still has a salvage value as indicated.

Paragraphs three, four, and five of your letter refer to an inconsistency between methods one, two, and five. You point out that we have taken differential operating costs in one instance and earnings before depreciation in another. In all the examples we believe you will find that depreciation has been deducted after you arrive at the differential operating costs. The differential operating costs are what permit you to justify the additional cost of using the proposed equipment. Depreciation, income taxes, and interest on investment are deducted from this.

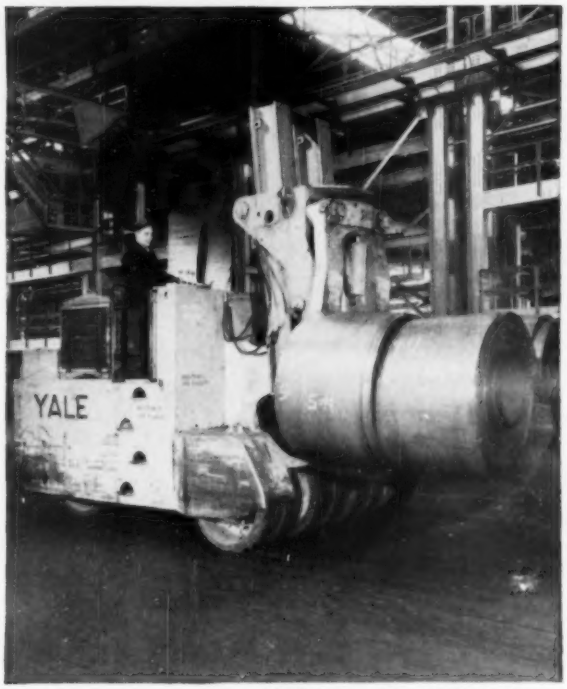
The accounting and pay-back methods are not advocated and should not be used as criteria for the investor's method. But by going through the successive steps of subtracting taxes, depreciation, and interest, you approach a rate of return that approximates the true rate of return by the investor's method. Methods one and two are inadequate for the reasons not checked in the check chart in the article.

To help you understand what we

B.F.Goodrich

Pneumatic tires

B.F.Goodrich makes a complete range of sizes and variety of tread designs, including the new All-Purpose.



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Pressed-On Solid in regular or Deluxe Cushion, or Vulcanized-On Solid—which is right for you? What tread design? What compound?

Which industrial tires are right for your job?

Free B.F.Goodrich TW TIRE AND WHEEL Analysis tells you

Can save you as much as 50% on tire costs!

Problem: There are many different industrial tire types, sizes, tread compounds and tread designs. Each one is built for a specific materials handling job. Do you know which tires are right for *your* job?

Solution: Without cost or obligation your B.F.Goodrich Tire and Wheel Analysis man will study your equipment, loads, hauling surfaces and other special problems you have. He'll recommend the right tires for you to use—recommendations that are unbiased because B.F.Goodrich makes a *complete* line of industrial tires.

Result: You can save as much as 50% on industrial tire costs, as much as 20% on maintenance costs. Mail the coupon today for your FREE B.F.Goodrich TW Analysis.

A special consulting service is available to manufacturers of materials handling equipment.

Specify B.F.Goodrich tires when ordering new equipment

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A Division of The B. F. Goodrich Company
Department TW-744, Akron 18, Ohio

I would like further information on your FREE TW Analysis.

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COMPANY_____

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B.F.Goodrich *industrial tires*

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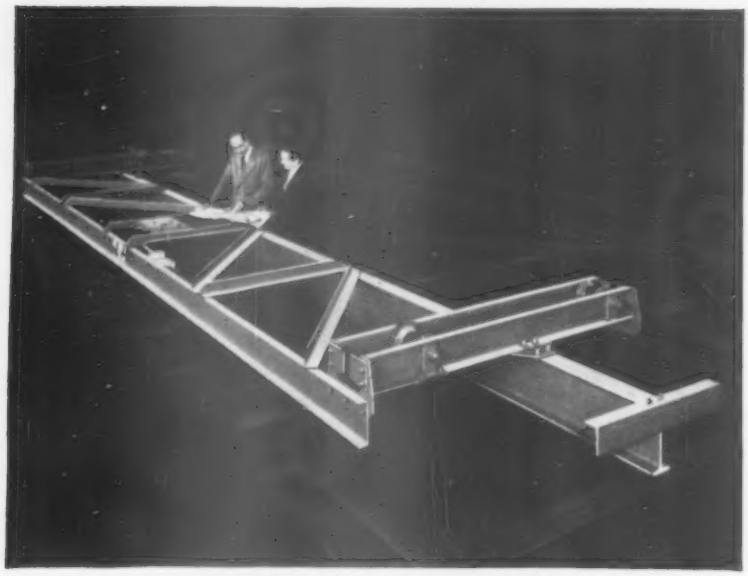

ABELL-HOWE

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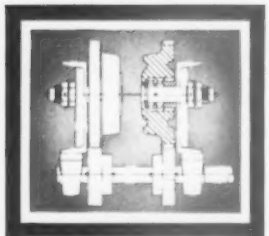
NOW WITH FORGED ALLOY STEEL WHEELS, GEARS AND PINIONS



another ABELL-HOWE *plus*

"QUICKLOCK" WHEEL ASSEMBLIES

Combine positive wheel mounting with immediate removability. To remove axle, simply loosen two nuts, twist axle 90° and pull it out. Wheels, too, are as easily removed with no dismantling of truck frame. "QUICKLOCK" is exclusive with Abell-Howe.

Only Abell-Howe offers you forged steel dependability at all critical points of wear—wheels, gears *and* pinions! Furthermore, Abell-Howe rugged outrigger construction keeps bridge in square—provides lateral bracing for bridge girder. Smooth fluid drive provides cushioned starts whatever the load—reduces reversing shocks. To further assure smooth operation and lasting service, anti-friction bearings used throughout—with double row ball bearings in end truck wheels. Here's crane value that can't be beat!

ASK FOR BULLETIN

ABELL-HOWE COMPANY *7767 W. Van Buren St., Forest Park, Illinois*

mean by earnings or savings we use the definition that it is money resulting from improved quantity and quality or decrease in expenditures for material, labor, and overhead. It goes without saying that if you are going to deduct depreciation, interest, and taxes in the final steps (as shown in the article) you would not figure these in your differential operating costs.—ED.

LONG-CYCLE JOBS

Sir:

The article "Quick Way to Measure Long Jobs" (FACTORY, Oct. 1958, p. 87) describes data that may have application in our plant. Is there a text or manual available about development and application of these data?

Robert G. Cates
Utility Trailer Mfg. Co.
City of Industry, Calif.

► The FACTORY article is the only information that has been published to date about this new "system" of standard data for long-cycle jobs. Further information can be obtained from the developers, H. B. Maynard Co., Inc., 718 Wallace Ave., Pittsburgh 21.—ED.

CONSULTING EDITOR

Sir:

I attended a recent seminar and was very happy to have had the opportunity to hear one of FACTORY's editors. He brought out during the course of his report that he had visited many plants with problems similar to ours.

I would consider it a very great privilege and a very great favor if he would come and take a look at us, and give us his suggestions as to what we should do, if anything, to make ourselves more modern.

(Name withheld)

► The life blood of an editor is visiting plants, meeting people, exchanging ideas. Obviously, when an editor visits a plant in the line of duty—seeking information or editorial material—he's more than willing to spend a part of his time answering questions, offering sug-

Meet Today's Needs for Higher Industrial Lighting Levels with fixtures bearing the

RLM Quality Label

New, Higher I.E.S. Industrial Lighting Recommendations make the RLM LABEL MORE IMPORTANT THAN EVER BEFORE!

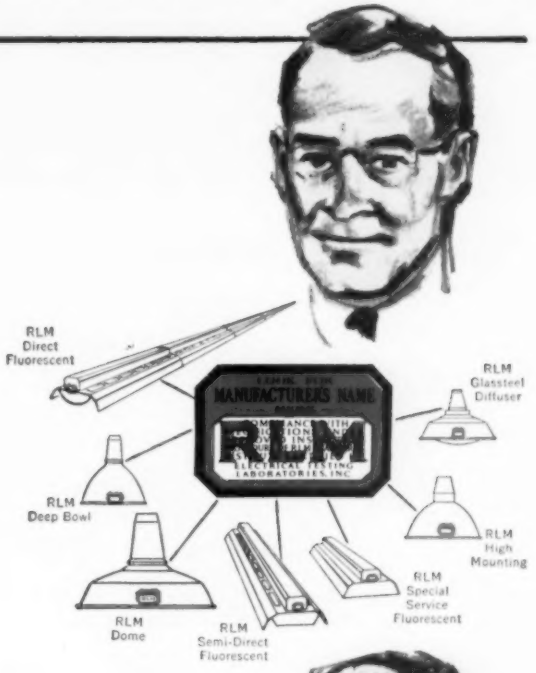
Q *Why do the new, higher, lighting levels now recommended by the Illuminating Engineering Society make the* **RLM LABEL** *More Important than ever?*

A *You can't have Quality Lighting without* **QUALITY LIGHTING FIXTURES.**

Higher Lighting levels put more importance on conformance to highest RLM concepts of lighting fixture design, construction, performance and maintenance features.

Q *What is meant by... "Only the RLM Label provides this essential warranty of* **UNIFORM QUALITY..."?**

A *It takes over* **1000 WORDS** *to cover the RLM specifications* for each type of fixture. Further, it requires the services of the Electrical Testing Laboratories of New York (an independent engineering organization) to insure uniform and consistent conformance by making periodic tests from samples secured both from the production lines and the field stocks of every participating manufacturer. The simple passing of the tests by the submission of a sample or samples is not enough. To be entitled to the RLM Label, fixtures are subject to continuous examination and must uniformly meet the RLM quality Spec's so as to insure unvarying quality from fixture to fixture.



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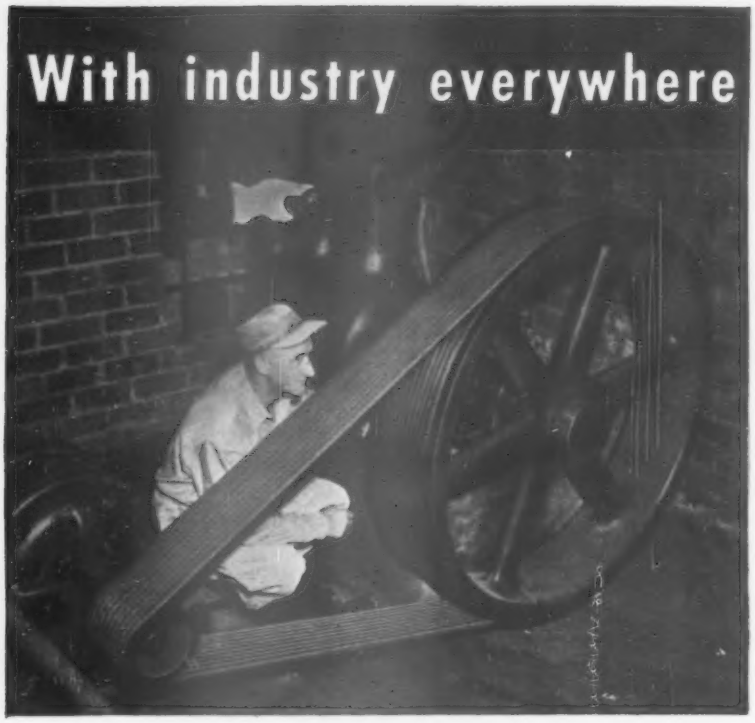
Company.....

Address.....

City..... Zone..... State.....



the No. 1 choice is the V-belt with concave sides

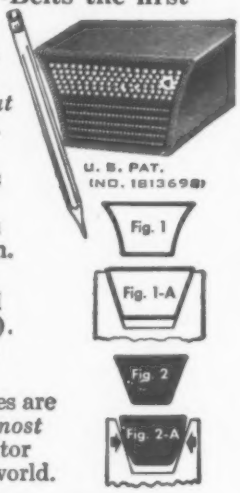
It is easy to see why concave sides insure far longer belt life... and make Gates V-Belts the first choice of industry everywhere.

Just *make this simple test:* bend a Gates V-Belt as if it were going around a sheave. Feel how the concave sides (Fig. 1) *fill out* ... become perfectly straight (Fig. 1-A).

Note how this belt thus makes full contact with the sides of a sheave ... grips the sheave evenly, distributing wear uniformly across the sides of the belt. Uniform wear lengthens belt life — keeps costs down.

With a straight-sided belt (Fig. 2) the sides *bulge out* when the belt is bent, and wear is concentrated on the bulge (Fig. 2-A). Uneven wear shortens belt life — increases belt costs.

Because Gates V-Belts with concave sides are so universally preferred, they are also the *most widely available.* There are Gates Distributor stocks in industrial centers throughout the world.



The Gates Rubber Company, Denver, Colorado

Gates — *World's Largest Maker of V-Belts* — TPA 260

Gates VULCO ROPE Drives

FACTORY / LETTERS

Begins on page 8

gestions (if requested) on problems in the plant. Doing this, of course, is one way we can say "thank you" for the hospitality and cooperation management has extended to our editors. On the other hand, our editors cannot undertake to perform the function of a consultant. To do so, we would be able to serve only a handful of people. As editors, our first—and only—responsibility is to all the 65,000 subscribers of FACTORY.—ED.

WHEN DO WE START?

Sir:

We would like to know if you have made any studies or surveys that would indicate whether in factory operation there is greater operating efficiency if the plant starts at 7 a.m. rather than at 8 a.m. or any other hour. We are considering changing our starting hour, and we want to know which hour would contribute most to optimum factory efficiency.

Willard C. Jones
Director of Manufacturing
The Gray Mfg. Co.
Hartford, Conn.

► There are a number of studies of worker efficiency during the various hours of a shift (generally highest in mid-morning and mid-afternoon), but we've never seen one that provided data relating to alternate starting times. If any reader has had experience with a change in starting hour, we'd like to learn about it so that we can pass the word along to Mr. Jones and others interested in the problem.—ED.

ACCIDENT HAZARD

Sir:

On page 152 of your October issue you present a picture of a man "listening" to his mail while driving his car to and from work.

My first reaction was that this is an accident hazard. You can become so intent in the listening that you will be much less alert to the traffic hazards that require split-second action.

J. F. McDonnell
Chief Accountant
U. S. Rubber Co., Passaic, N. J.

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STAINLESS STEEL VALVES *too*

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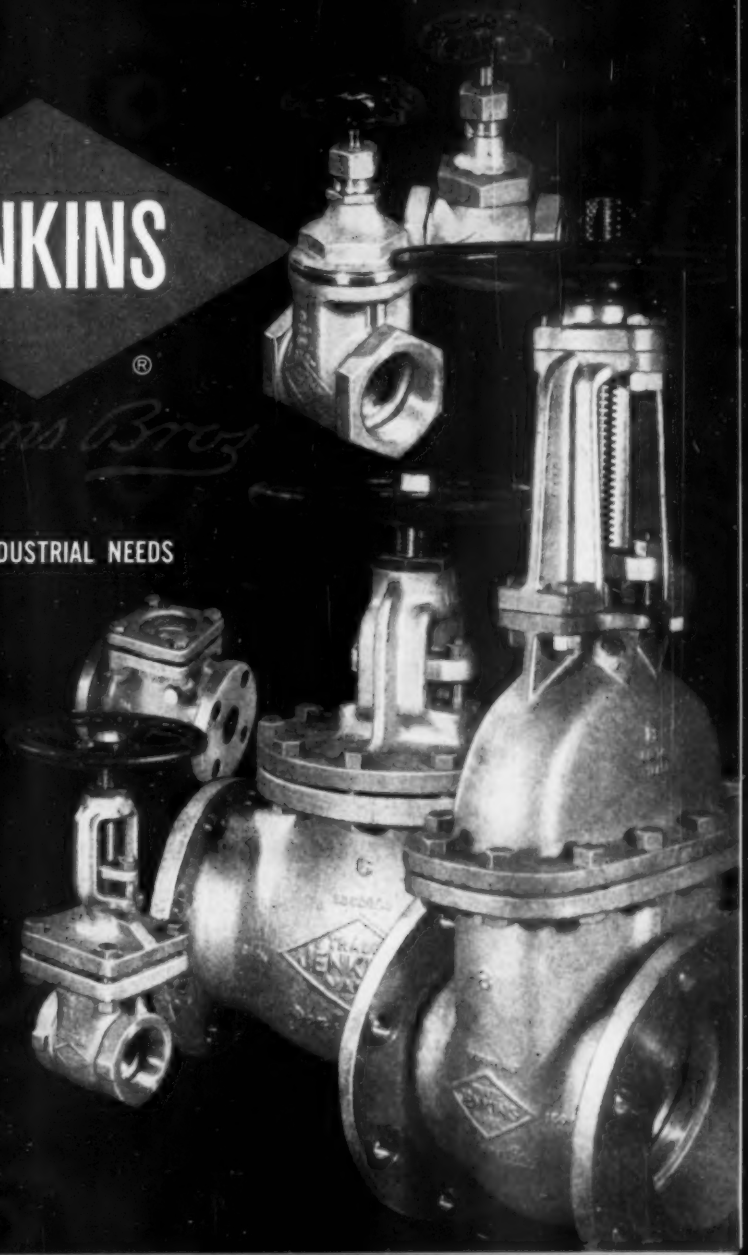

PATTERNS AND ALLOYS TO SATISFY MOST INDUSTRIAL NEEDS

For solid reasons, men who ask for the best in Stainless Steel Valves have full confidence when they see the Jenkins Diamond. For almost a century this mark has appeared only on valves made to peak standards of quality in design . . . in castings . . . in machining. JENKINS standards, enforced by the most rigid inspection and testing in the valve industry.

Valves of corrosion resistant stainless steels have been made to those high standards by Jenkins for a quarter of a century. And today, the line of Jenkins Stainless Steel valves includes types and alloys to fully satisfy most service requirements.

They are available through the same leading distributors everywhere who sell Jenkins Valves of Bronze, Iron and Cast Steel. Jenkins Bros., 100 Park Avenue, New York 17, N. Y.

NEW JENKINS STAINLESS STEEL VALVE CATALOG
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HERE is a new dimension in plant automation and supervisory process control. See where you can't be . . . every critical area . . . from a single, central control point.

With a new, high-definition Philco ITV system you can maintain constant visual control over materials in-process, hot rolling and forming, chemical and catalyst flow, batching and mixing operations, positioning of materials and assemblies in process, crushing and grinding operations and all other manufacturing operations.

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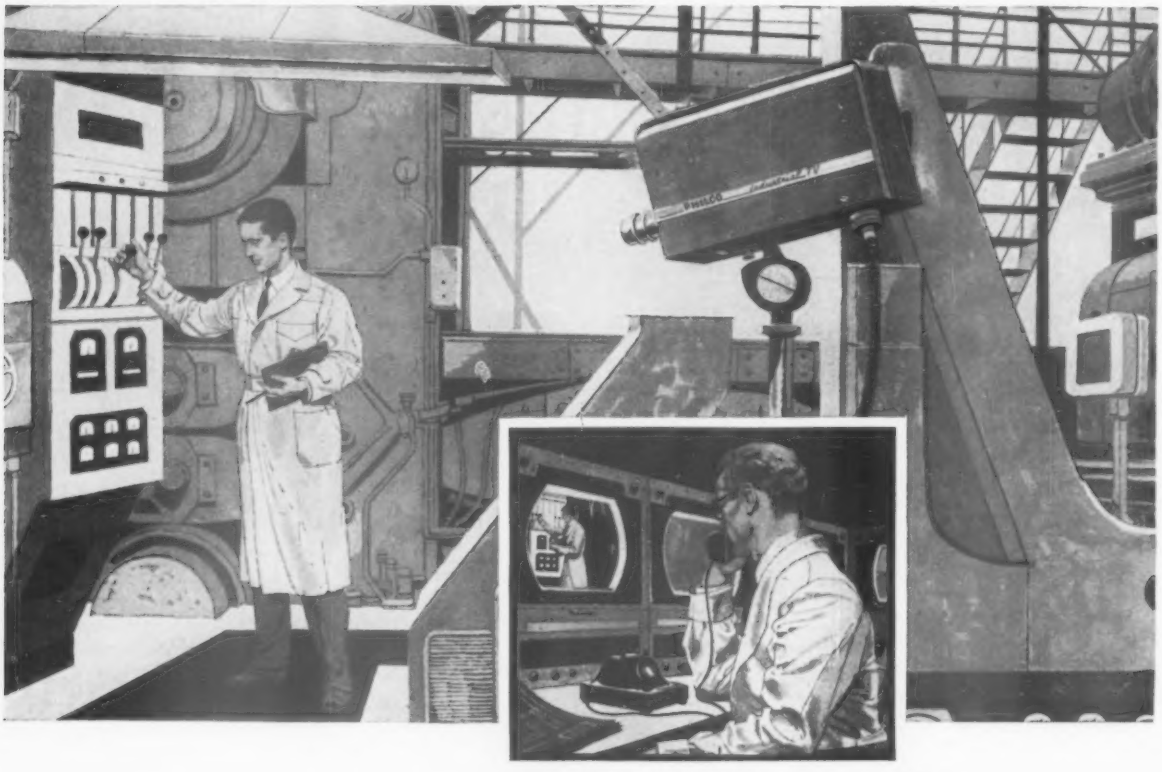
Philco's complete line of ITV accessories extends the use of your basic system and permits maximum flexibility. Remote pan and tilt . . . remote iris and focus . . . Auto-Zoom lenses . . . lens turrets . . . weatherproof housings . . . explosion resistant housings . . . all assure complete versatility and adaptability to any installation through Philco's "building block" techniques.

For economical and efficient remote visual control . . . specify Philco ITV Systems. Send for illustrated brochure, describing complete Philco ITV equipment and systems.

At Philco, opportunities are unlimited in electronics and mechanical research and engineering.



PHILCO®

GOVERNMENT & INDUSTRIAL DIVISION

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In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario

For more facts Circle 461 on Reader Service Card

For more facts Circle 462 on Reader Service Card ➤

Pittsburgh Color Dynamics®
in new Graflex Plant

World-famous maker of precision cameras uses modern painting system to improve efficiency and safety of workers

Graflex, Inc. of Rochester, New York, has used Pittsburgh COLOR DYNAMICS for many years to improve productive efficiency and safety of its workers. As a result of its highly satisfactory experience, the new building recently completed to house main offices and manufacturing facilities, has been completely painted according to the principles of this modern color system.

● **In this new structure,** with 225,000 square feet of floor space, this pioneer maker of cameras, now part of the General Precision Equipment Corporation, continues to produce photographic and electronic equipment of exceptional versatility and reliability for civilian and military use.

● **"Our production requires** precision and accuracy," comments M. B. Moore, Graflex vice-president and factory manager. "We strive to provide our operators with best possible lighting conditions. Our experience has proved that COLOR DYNAMICS, with its focal and eye-rest colors on walls and machines, helps them see their work better. Eye strain, nervous tension and physical fatigue are reduced."

● **"Safety colors on controls** and traffic areas have lessened danger of time-loss accidents. Our workers are proud of their cheerful surroundings. They keep work areas clean and orderly, reducing housekeeping. Long-time experience with COLOR DYNAMICS has shown it to be economical. We enjoy its benefits at no greater cost than conventional maintenance painting."

How You Can Get A COLOR DYNAMICS Plan—FREE!

● Why not try painting the COLOR DYNAMICS way in your plant? Send for fully-illustrated free booklet which explains how you can improve efficiency, morale and safety of your employees with this modern painting system. Better still, arrange to get a COLOR DYNAMICS plan of your plant without cost or obligation. Call your nearest Pittsburgh Plate Glass Company branch and arrange to have a representative see you. Or mail coupon at right.

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Pittsburgh Plate Glass Co., Paint Div.,
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☐ Please send me a FREE copy of your booklet "COLOR DYNAMICS."

☐ Please have your representative call for a COLOR DYNAMICS survey without obligation on our part.

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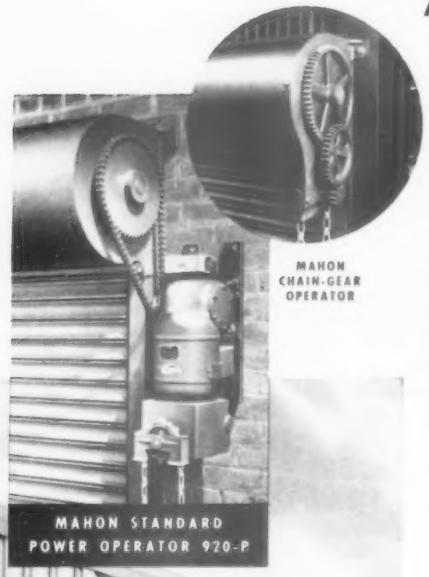
Street _____

City _____ County _____ State _____

Rolling Steel Doors

Manually, Mechanically, or Electrically Operated



MAHON CHAIN-GEAR OPERATOR

MAHON STANDARD POWER OPERATOR 920-P

For new plants, and replacement in old plants, rolling steel doors offer the permanence of steel plus definite timesaving and space saving advantages in any type of opening. Whether it be a truck opening, railroad opening or shipping dock opening, the fast, vertical roll-up action of the door curtain requires no usable space either inside or outside the opening . . . there are no overhead tracks or other obstructions to restrict headroom or interfere with crane handling. And the all-metal construction of rolling steel doors reduces maintenance to a minimum and provides maximum protection against intrusion and fire. No other type of door can provide these important features which are so necessary for functional efficiency in door openings today. When you select a rolling steel door, check specifications carefully . . . you'll find, through comparison, that Mahon Rolling Steel Doors are built better to give you better service over a longer period of time. See Sweet's Files for complete information, including specifications, or write for Mahon Catalogue G-59.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales-Engineering Offices in Detroit, New York and Chicago • Representatives in Principal Cities

Manufacturers of Rolling Steel Doors, Grilles, and Automatic Underwriters' Labeled Rolling Steel Fire Doors and Fire Shutters; Underwriters' Rated Metalclad Fire Walls, Insulated Metal Curtain Walls, Electrified M-Floors, Acoustical and Troffer Forms, Acoustical Metal Ceilings, Steel Roof Decks, and Long Span M-Decks.

ROLLING STEEL DOORS, SHUTTERS AND GRILLES TO MEET EVERY REQUIREMENT

Above you see Five of the Ten Mahon Rolling Steel Doors installed in a new Plant for The Lamson & Sessions Co., Cleveland, Ohio. The Mahon Company also supplied the Structural Steel, Electrified M-Floors, Steel Roof Deck, and Aluminum Curtain Walls for this modern Manufacturing Plant. George S. Rider Co., Architects & Engineers; Sam W. Emerson Co., General Contractors.

MAHON

First time you've ever seen a conveyor screw changed so fast!

First, take out coupling bolts and filler piece from right-hand end of section to be removed.

Second step: take out coupling bolts and filler piece from the preceding section.

Rotate screw being removed 180 degrees so slot on preceding section is up. Then unbolt hanger.

Now simply lift the conveyor section from the trough and assemble the new one in its place.

RUNNING AGAIN. After less than 30 minutes, the conveyor is back at work.

LINK-BELT Quik-Link conveyor screw eliminates need to pull down entire conveyor line

Down-time is held to the barest minimum with the Quik-Link conveyor screw. It speeds and simplifies the maintenance man's job . . . other components need not be dismantled. And Quik-Link is just one of a whole group of new Link-Belt screw conveyor components that are cutting maintenance and power demands to a new low.

- *BALL BEARING HANGER*—has self-aligning bearing and seal, adjusts to deflection.
- *BALL AND ROLLER BEARING COUNTERSHAFT END*—connects two conveyors at right angles, permits use of a right-angle drive.
- *TROUGH END SEAL*—keeps grease in, dirt out. Used with lip, felt or waste packing seal to prevent bearing-product contact.
- *DOUBLE BALL BEARING FLANGE BLOCK*—resists overhung loads at drive end and takes thrust loads of screw.

For complete facts, call your nearest Link-Belt office or authorized stock-carrying distributor. Or write for Folder 2489.

LINK-BELT

SCREW CONVEYORS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 14,013

Lubrication

SPECIALLY TRAINED OPERATORS now machine "Teflon" to tolerances of .001" with Texaco Cleartex BX.

ANSWER TO "TEFLON" MACHINING PROBLEM FOUND BY THROWING OUT STANDARD CUTTING TECHNIQUES

DuPont's new thermoplastic, "Teflon" (or, more precisely, Polytetrafluoroethylene resin) has a combination of properties which makes it uniquely advantageous in a number of applications.

They also make it uniquely difficult to machine.

Unlike other thermoplastics, "Teflon" does not flow well in its melted state. This, plus the fact that the molding process requires extremely high temperatures, makes molding to close tolerances difficult. "Teflon" must be machined from rod stock when tolerance is a critical factor.

Special machining problems. Standard cutting techniques cannot be applied to "Teflon" machining, according to Mr. S. Mulay, President of Tri-Point Plastics, Inc., Albertson, N. Y. His firm, which specializes in working DuPont's new product, had to invent new cutting techniques and retrain operators to cope with "Teflon's" special characteristics. In spite of these steps, the materials–tools and lubricants–used in the machining process still gave Tri-Point trouble.

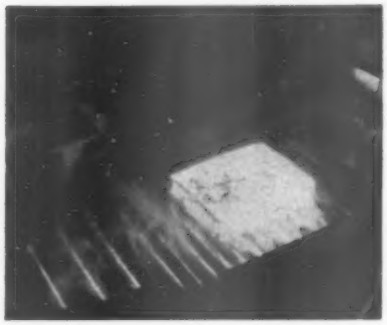
Cutting oil a critical factor. It soon became obvious that standard cutting oils used for ordinary metalworking were not adequate for "Teflon" machining. Although "Teflon" is not an abrasive material, its very low thermal conductivity coupled with its high heat resistance tended to shorten tool life by actually burning cutting edges. These high temperatures also warped the machined part, making close tolerances almost impossible. Finally, "Teflon's" white color made it extremely difficult to see the work through soluble oil emulsions–which otherwise might have solved the problem.

Tri-Point calls in Texaco. At this stage Tri-Point turned to the expert – a Texaco Lubrication Engineer. He outlined the need: a transparent cutting oil with the ability to remove the maximum amount of heat. After considerable study and testing, he recommended switching to Cleartex BX whose characteristics seemed precisely to fit the situation. His choice has proved to be right. Now Tri-Point uses this oil exclusively, with excellent results. Tool replacement has dropped significantly, and Tri-Point can count on maintaining "Teflon" tolerances of .001".

Pressure plus heat presents two-way lubrication problem

There is a definitely established trend today toward higher and higher temperatures in industrial processes in almost every type of industry. Mill rolls, plastic extruding machines and steam joints are only a few of the many applications which now involve temperatures well over 300° F. combined with high pressures. This combination has presented a severe lubrication problem – particularly in grease-lubricated equipment.

Nature of grease creates problem. As temperature rises, the consistency of grease decreases – most greases become virtually useless at temperatures above 350°. Furthermore, high heat will usually cause rapid oxidation and deterioration in a relatively short time.



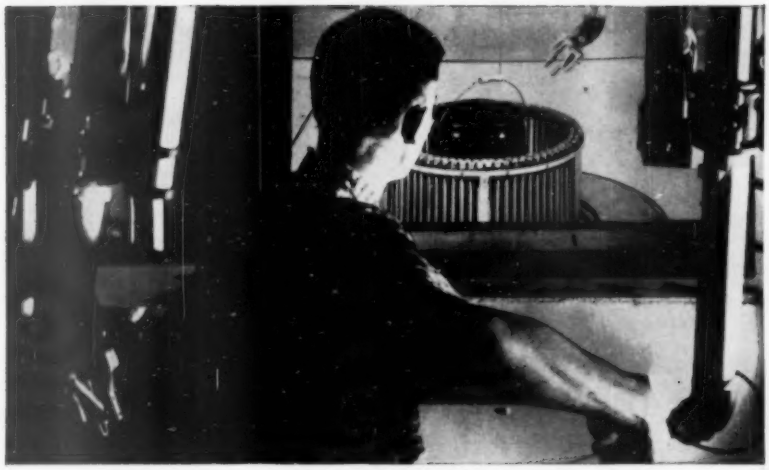
Unique new grease resists both forces. Texaco has now developed a new product whose remarkable performance in two years of field tests seems to answer the problems of *both* high heat *and* extreme pressure–Thermatex EP-1.

Thermatex is unique in its high resistance to both these forces.

Protects 400° equipment for two years. Thermatex has been field-tested for two years as the lubricant for steam joints in a paper mill. Previous products used had solidified and coked after two weeks of exposure to the extreme pressures and 400° F. heat, causing failure of the joint. Thermatex, on the other hand, has kept the steam joints operating without failures–and without significant wear–for two years.

news

TEXACO



GAMMA-RAY "HOT CELL" AT BEACON contains radioactive Cobalt-60.

Nuclear energy harnessed to crack the secret of better lubricants

Lubricants finer than the ones available from even the most advanced standard refining techniques will soon be produced by Texaco—with the help of nuclear radiation. Completely *new* lubricants are a real possibility, too—lubricants with atomic structures stronger and more cohesive than anything now available.

To open up this new frontier in lubrication, Texaco has assembled the most fully equipped nuclear laboratory in American industry. Texaco scientists have been put in command of all four basic irradiation forces—electrons, positive ions, gamma rays and neutrons—and are now probing the activity of hydrocarbon molecules during refining.

In addition to the Cobalt-60—rated at 29,000 curies—Texaco scientists have at their disposal a 6- to 10-million electron volt linear accelerator and a 3-million electron volt positive-ion Van de Graaff generator. The linear accelerator, or "electron gun," was especially designed and built for Texaco and is probably the only nuclear instrument of its kind now in use by a commercial firm for its own fundamental research.

Searching analysis of deposit problems

The January 1959 issue of *Lubrication Magazine* is entirely devoted to deposit problems—their causes, prevention and solutions. This article should be of vital concern to every engineer who has to cope with this often-costly lubrication problem. See coupon.

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MOVIE OF THE MONTH

★★ SEE! ★★

"HYDRAULICS"

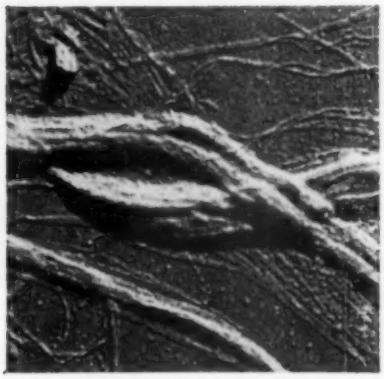
"One of the year's most informative movies!"

—Paul Rolnick, Editor, *Applied Hydraulics*

NEW PRODUCT NEWS

Nondrying protective coating keeps parts free from rust and corrosion for as long as a month during inter-process handling, storage, and shipment: *Texaco 564 Rustproof Oil.*

New, easy-to-apply gear lubricants won't drip in hot weather or flake off in cold—are ideal for many open-gear applications: *Texaco Geartac.*



How working splits grease fibers.

80,000x electron microscope explores grease structures

One of the most important tools of research, the electron microscope, is helping in the development of new and better greases. By understanding the nature of grease structures and their reaction to various conditions, Texaco scientists can create greases that are suitable for many different purposes.

THE TEXAS COMPANY, Dept. F-LN-10
135 East 42nd Street
New York 17, New York

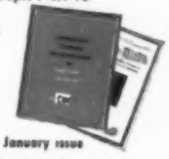
Dear Sirs:

☐ I am interested in seeing "HYDRAULICS"

I would like a free copy of

☐ Lubrication Magazine – January issue

☐ Management Practices that Control Costs via Organized Lubrication



Name _____ Title _____

Firm _____

Address _____

City _____ State _____

SIOUX impact offer Torque

BIG "SLUGGERS!"

The SIOUX No. 320 and 322 air impact wrenches achieve a new high in power to weight ratio. Certified torque as shown in specifications with 8 points of power selection makes them most ideal for heavy duty work.

More than MEDIUM!

No. 315 and 316 are popular industrial and general use sizes with great versatility of use and power for extra punch. They're designed for use where power is required beyond that of conventional ½" drive wrenches.

Medium POWER

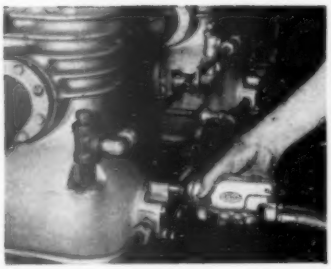
No. 315 and 316 cover a torque range adequate for many purposes. They're thoroughly tested and proven. Thousands are in daily use.

SIOUX *Electric* IMPACT WRENCHES

Sioux electric impact wrenches offer equal power in right or left hand rotation. The torque for each wrench is stated and certified. Their mechanical design offers exactly the same advantages as that of the air wrenches. Their exclusive reverse cap switch lock prevents reversing with the current on, and eliminates burning commutator brushes and switch contacts. They are unexcelled in performance.

wrenches

for every task!



CERTIFIED SIOUX POWER

SIOUX tells you the torque your air or electric impact wrench will deliver. (See specifications.) You don't buy just a wrench. You buy certified SIOUX power! Reversible power. And on air wrenches controllable power through eight point power selector.

PROVEN EFFICIENCY

Here, the advantage of the exclusive SIOUX mechanical design is revealed! You can expect your SIOUX air impact wrench to deliver *25% more torque* while *consuming 30% less air!* Less power is absorbed by the wrench itself. More is applied to the drive!

FIELD TESTED, TIME TESTED PROVEN DEPENDABILITY

The exclusive SIOUX impact wrench mechanical design has passed the toughest test of all . . . the test of time. Thousands have been giving dependable, trouble-free service for years.

REACTION BALANCED for Less Vibration Feedback

All SIOUX Impact Wrenches are "reaction balanced" for less vibration and torque feedback and for minimum operator fatigue. You can feel the difference!

ANGLE ATTACHMENT— used directly on the square of the impact wrench to reach those hard to get at spots.

Compare the TORQUE! the QUALITY!

Cat. No.	AIR Square Drive	Cap. Bolt Size	Torque Ft. lbs. at 90 lbs. Air Pressure at Tool
313.	3/8"	3/8"	60
314.	1/2"	7/16"	75
303*	1/4" Hex		
315.	1/2"	5/8"	.130
312*	7/16" Hex		
316.	1/2"	5/8"	.195
317.	5/8"	5/8"	.195
318.	5/8"	3/4"	.250
319.	5/8"	7/8"	.425
320.	3/4"	1"	.750
322.	1"	1 1/8"	1000

*AIR SCREWDRIVER Cat. No.	ELECTRIC Square Drive	Cap. Bolt Size	Torque Ft. lbs. in 10 sec. operation Right or Left
323.	3/8"	7/16"	75
333.	1/2"	7/16"	75
325.	1/2"	5/8"	.125
330.	1/2"	5/8"	.175
335.	5/8"	5/8"	.175

ALSO NO'S. 260, 262, 242, 246 ELECTRIC SCREWDRIVERS

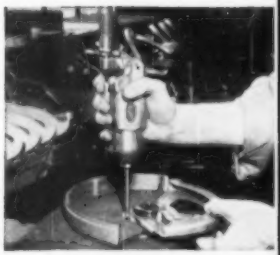
Production type No. 313, 314!

AIR IMPACT WRENCHES

These models feature an exclusive remote air exhaust that takes exhaust 6 feet from the operator. Quiet, clean operation. Production type design with paddle switch, and 8 point torque selector.

No. 303 AIR IMPACT SCREWDRIVER

Same as above except takes ¼" hex drive shanks for clutch head, Reed and Prince, standard, and Phillips screwdriver bits, and for Allen type socket heads.



SIOUX's the BUY!

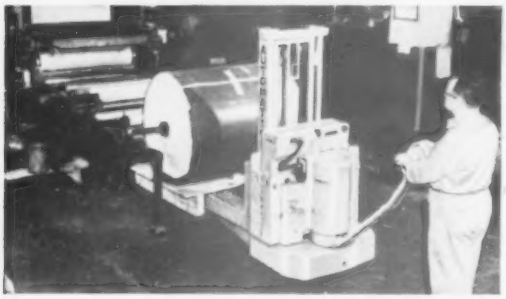
ALBERTSON & CO., INC. SIOUX CITY IOWA, U.S.A.

AIR IMPACT WRENCHES • AIR SCREWDRIVERS • DRILLS • "PELICAN" NUT ACCUMULATORS • FLEXIBLE SHAFTS • ELECTRIC IMPACT WRENCHES • GRINDERS • SANDERS • POLISHERS • SCREWDRIVERS • PORTABLE SAWS • VALVE FACE GRINDING MACHINES • ABRASIVE DISCS

For more facts Circle 466 on Reader Service Card

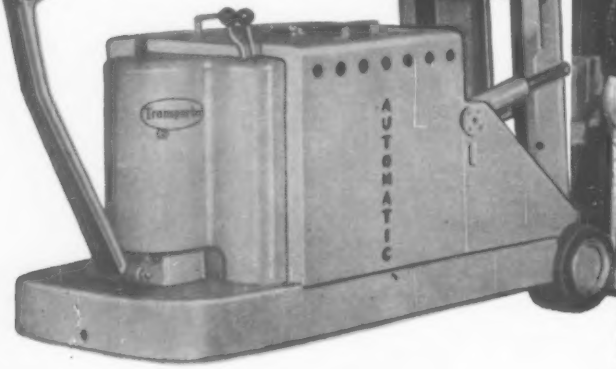
AUTOMATIC

Low-lift pallet Transporter with skid adapter handles both pallets and skids. Model WP has narrow battery compartment for normal use in congested areas... **Model WPY** has wide battery for heavy-duty use. **Models WP** and **WPY** available in capacities of 4000 lbs. and up.



High-lift Platform Stacker spots bulky skidded loads in production or storage areas. Model WLT...capacities 2000 lbs. and up.

High stacking for pallet racks or unit loads, yet easily enters low over-the-road trucks. Only Automatic offers the NEW SKYLIFT Mast...68" mast lifts 144"...for cantilever type stackers in 2000 lb. and 3000 lb. capacity. **WST Model** available in 1000 to 4000 lbs. capacities.



Straddle stackers handle loads in extremely narrow aisles. Load is carried on forks between outrigger arms... eliminates need for counterweight. **Model WAT** capacities range from 2000 to 15,000 lbs.

Transporters

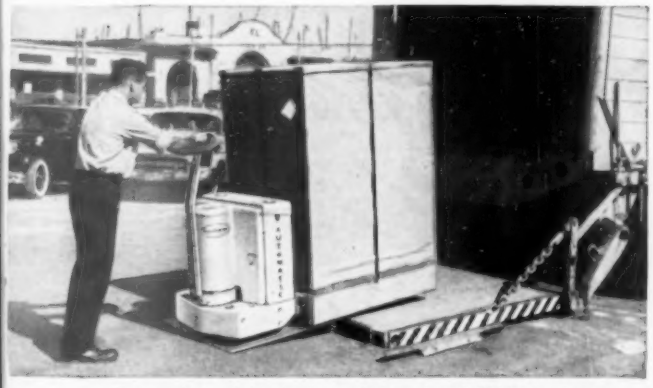
Versatile...Compact...Powerful...

and how they'll cut your handling costs!

For the 1001 jobs in your plant that a walkie-type truck can do, it's your best materials handling buy, dollar for dollar. Walkies naturally cost much less than rider type trucks. So, the same money buys you more units...mechanizes more jobs with greater plant efficiency. The lightweight walkie costs less to operate...and can work easily in areas unsafe or too crowded for the larger, heavier rider-type trucks, yet performs essentially the same functions.

Find exactly what you need in Automatic's Complete Transporter Line

There's an *Automatic Transporter* that's exactly right for your needs. If it isn't among the "popular six" shown here, you'll surely find it among the 50 standard models which can be varied to satisfy the most highly specialized requirements. And...you can have that just-right Transporter on convenient lease or budget purchase terms if you wish.



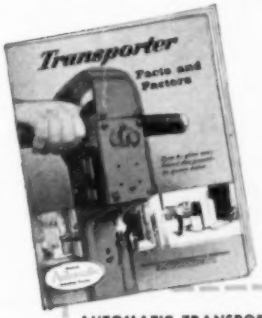
Transporter carried on truck speeds deliveries of skid loads of paper by the use of hydraulic tail gate. Model WW has narrow battery compartment for normal use in congested areas...**WWY** has wide battery compartment for heavy-duty use. **Models WW** and **WWY** available in capacities of 4000 lbs. and up.

Walkie-rider tractor speeds the selection of order picking...one of several tractor models. Capacities range from 200 lbs. normal to 1000 lbs. breakaway drawbar pull.

Electric Automatic® Industrial Trucks

Cost less to own...less to operate

AUTOMATIC TRANSPORTATION COMPANY
Division of The Yale & Towne Manufacturing Company
39 West 87th Street—Dept. B-9-Chicago 20, Illinois
WORLD'S LARGEST EXCLUSIVE BUILDER OF ELECTRIC-DRIVEN INDUSTRIAL TRUCKS



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16 pages of informative facts, figures and illustrations reflecting the latest knowledge in materials handling techniques. A reliable guide to finding the right solution for your materials handling problems. Send for your free copy today.

AUTOMATIC TRANSPORTATION COMPANY
Division of The Yale & Towne Manufacturing Company
39 West 87th Street • Dept. B-9 • Chicago 20, Illinois

☐ Send me a free copy of Transporter Facts & Factors.
☐ Send me details of budget purchase and lease plans.

Your Name_____ Title_____
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THIS CATALOG ILLUSTRATES
THE WORLD'S MOST
DIVERSIFIED LINE
OF STEEL EQUIPMENT
IT'S FREE!

★QP

★QUALITY PROTECTED BY LYON "POINT-CHECK" SYSTEM

✓ FABRICATING | ✓ ASSEMBLING
✓ FINISHING | ✓ PACKAGING

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See your Lyon Dealer for prompt delivery of the world's most diversified line of steel equipment

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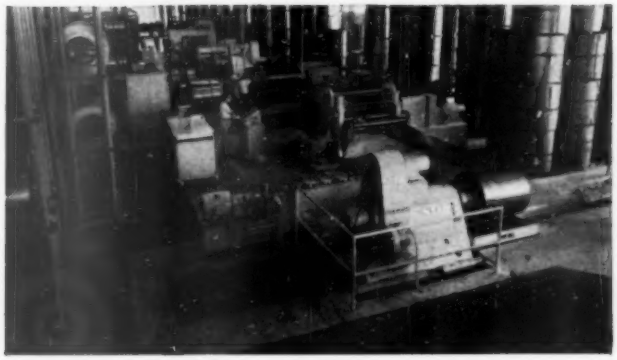
Factories in Aurora, Illinois and York, Pa.
Dealers and Branches in all Principal Cities

LYON®
STEEL EQUIPMENT

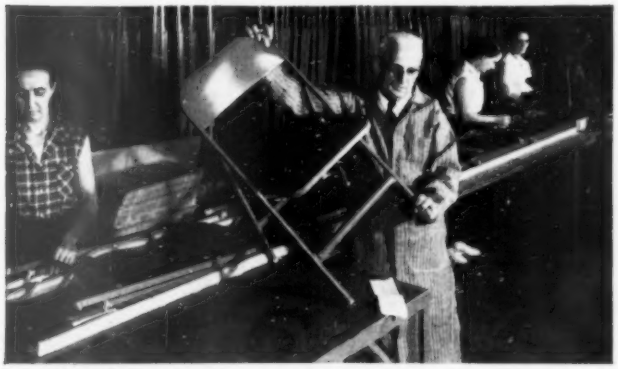
FACTORY

Here is Lyon "Point-Check" System in ACTION!

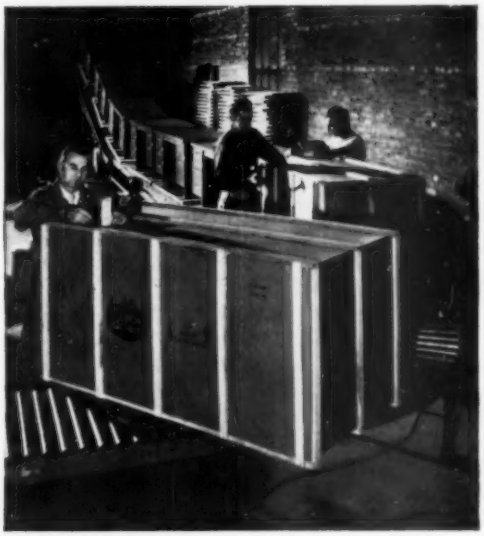


FABRICATING Above—automatic uncoiling and cutting of steel, the first of many operations which are checked against rigid standards. Lyon was the first manufacturer in its field to install this latest type equipment. At this beginning point, a regular check of material and cutting accuracy is standard procedure.

FINISHING to Lyon standards involves checking all finishing materials against rigid specifications, precision application with latest painting equipment, followed by final checking after finish is baked on.



ASSEMBLY of Lyon equipment is an important combination of many different operations, each one of which is checked regularly. Locks, catches and all moving parts must have smooth, positive action. Above, folding chair is checked as it leaves assembly line.



PACKAGING is the final and very important operation. Here Lyon has a check system which assures proper packing in cartons and crates specifically designed for maximum protection with minimum bulk and weight. Above, final checking of crated office desk.

•

SEE YOUR LYON DEALER FOR QUALITY PROTECTED STEEL EQUIPMENT

Lyon Metal Products, Inc.
212 Monroe Avenue, Aurora, Illinois

Please send me my free copy of Lyon 84-page Catalog #100.

NAME_____

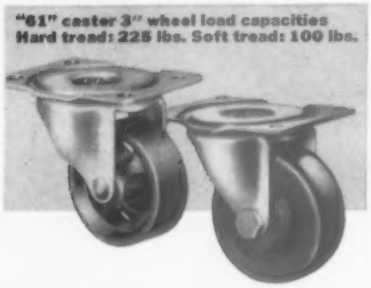
FIRM_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

MATERIALS-HANDLING NEWS

NEW AND UNUSUAL APPLICATIONS OF BASSICK CASTERS THAT MIGHT BE ADAPTED TO YOUR HANDLING PROBLEMS



Many factors affect caster load capacities

Types of wheels, floor conditions, speed of travel must be considered in selecting casters. Bassick conservative load ratings protect users and are based on average operating conditions.

HARD VS. SOFT WHEELS

Soft rubber tread wheels protect floors but limit load capacity. Good rule of thumb is that soft tread wheels will carry half the load carried by a hard tread wheel of the same size. Where floor protection is desired, go to a larger size resilient tread wheel.

Your Distributor has New Products

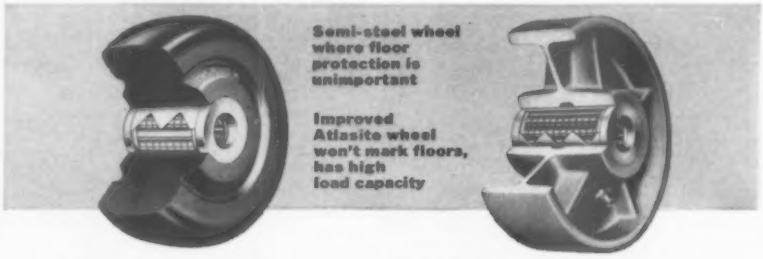
These new or improved products developed by Bassick last year may aid materials-handling in your plant.

Light Duty Floating Hub caster shown above for loads from 50 to *150* lbs.

Rust-resistant Zinc plating on all Bassick formed steel truck casters . . . at no extra cost.

New improved "non-marking" composition Atlasite wheel almost as strong as steel, far kinder to floors.

Keeping you up to date on new product developments is one of many ways your local Bassick distributor can help you.


Semi-steel wheel where floor protection is unimportant
Improved Atlasite wheel won't mark floors, has high load capacity

Rough floors cut load ratings

Select a wheel large enough to ride over tracks, door sills, elevators, other obstructions. For rough floors or in areas where there are objects or debris on the floor, use a larger wheel with extra load capacity to secure proper ease of rolling and satisfactory performance. Two types of caster wheel are shown above.

Now it moves . . . Now it stands still

Sometimes it's convenient to move a machine to the job and then hold it steady in operation. R. R. Donnelly & Sons Company, a Chicago printer, solved the problem by putting this package-tieing machine on Bassick casters (for movement) equipped with combination wheel brakes and swivel locks (for standing still). Might be an idea here for you.

Speed and power affect carrying capacities

This heavy duty series "93" caster will support a static load of 80,000 lbs., but nothing like that load in action. Its rated carrying capacity, for normal slow movement of heavy equipment, is a conservative 10,000 lbs. or 15,000 lbs., for 8" and 10" sizes.

It is not designed to stand the strain of fast power pulled applications, however. These jobs, where speed may exceed 5 mph, normally call for a Trailer type of caster such as the Floating Hub swivel trailer caster rated at 500 to 1000 lbs. per caster.

P.1

THE BASSICK COMPANY
BRIDGEPORT 5, CONN.
IN CANADA:
BELLEVILLE, ONT.

Symbol of Excellence
SW Bassick
A DIVISION OF
STEWART-WARNER CORPORATION

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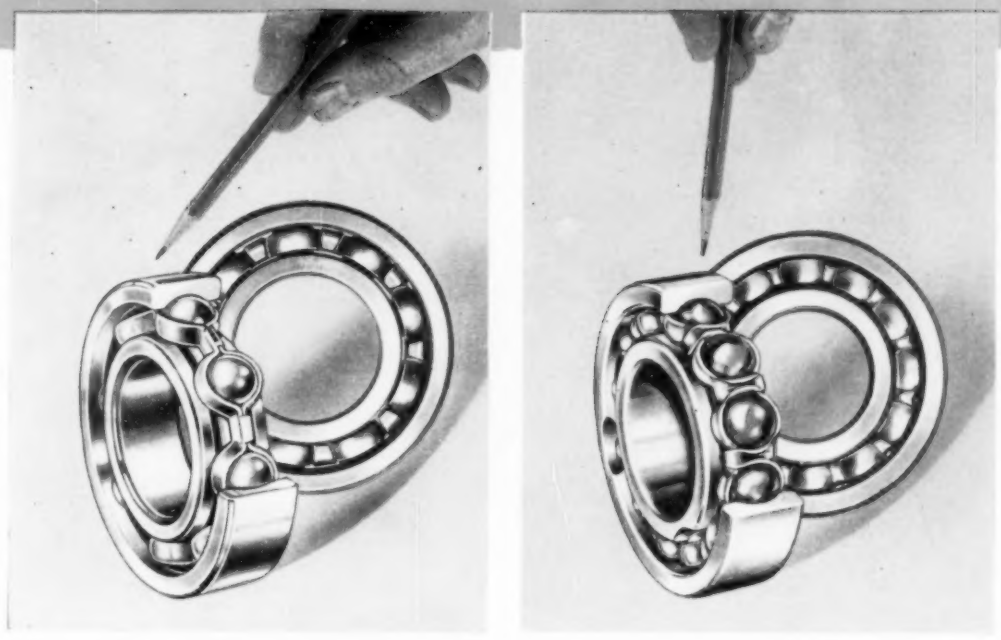
WHICH BEARING IS RIGHT FOR YOU?



Play it safe! Do business with an AUTHORIZED FAFNIR DISTRIBUTOR

Two ball bearings — both identical in size and made to the same tolerances.

The difference? The bearing on the left is a Conrad, or non-filling slot type. It is designed to take combined thrust and radial loads.

The other bearing — a filling slot type — features the maximum possible number of balls. It is generally specified where bearings are subjected to relatively heavier radial loadings, with only moderate thrust loads.

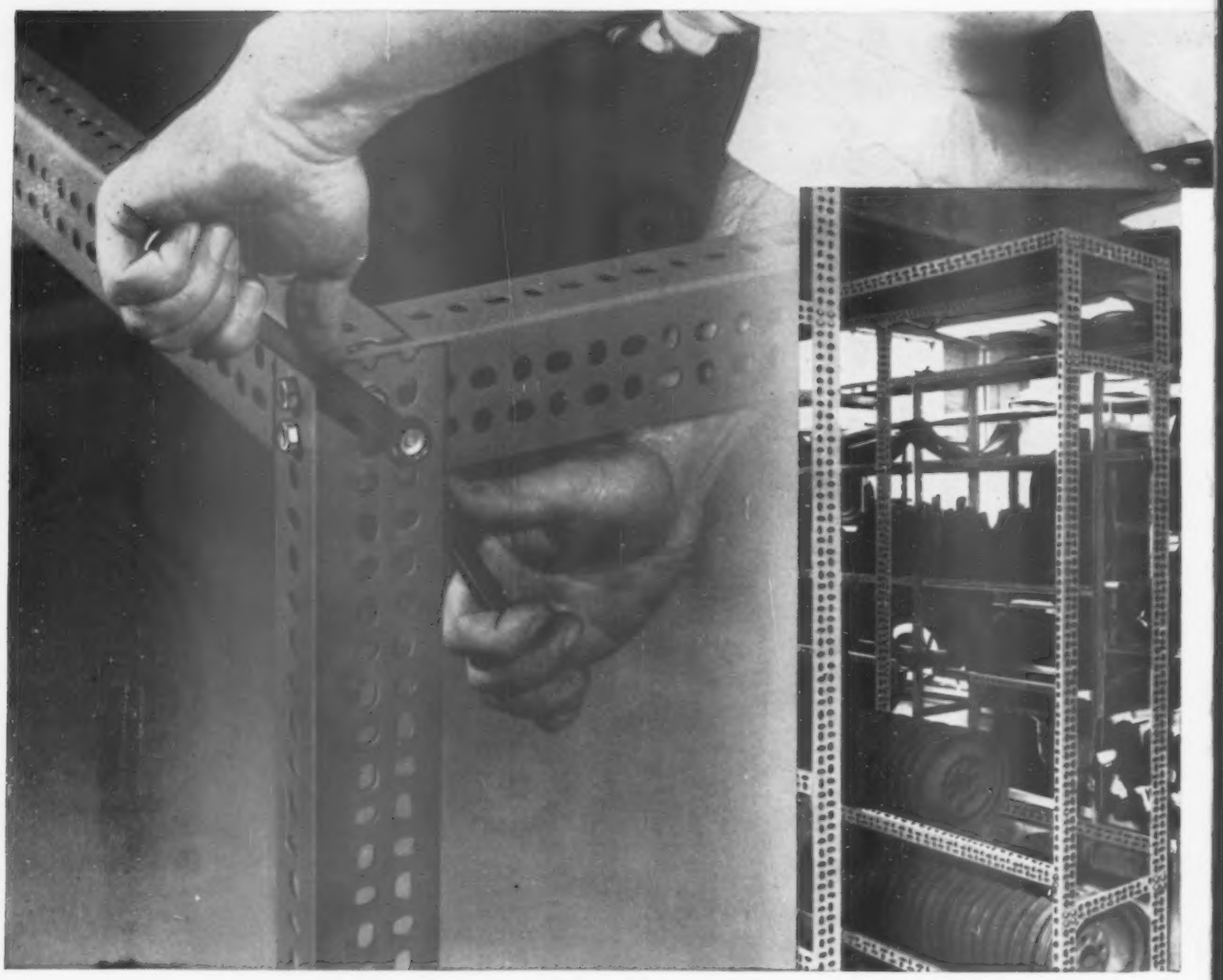
Differences such as this in bearings and bearing units can often spell the difference between proper machine performance and costly breakdowns. To be sure the bearings you buy are right for the job, do business with an Authorized Fafnir Distributor.

He's a bearing specialist. The know-how and expert technical services he offers are valuable extras available to you wherever you find the Fafnir sign.

What's more, by ordering from him, your bearing needs are met from stocks of the latest manufacture, and design. You avoid the risk of equipping with obsolete bearings, or units that are second-best substitutes.

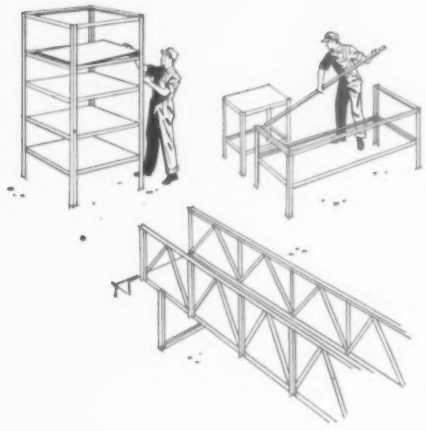
Play it safe! For the most effective and cooperative help with bearing selection, supply, and service, do business with your Authorized Fafnir Distributor.

THE FAFNIR BEARING COMPANY, New Britain, Connecticut



REPUBLIC METAL LUMBER

...new building material meets every framing need



Now . . . new building material made of steel with all the framing erection conveniences of common lumber. Republic's new slotted-angle METAL LUMBER is unlimited in application.

Secret is the precision-engineered system of short slots placed to allow ¾″ vertical and horizontal adjustment for utmost flexibility in meeting design requirements. Two-way short-slot pattern provides sufficient bolts in bearing to assure adequate joint strength. Easy to use—simply measure, cut, assemble.

Republic METAL LUMBER® is Bonderized, finished with baked enamel after fabrication for greater resistance to rust and damage. Delivered in easy-to-handle bundles of 10 angles, .080 gage or .104 gage, 10- or 12-foot lengths, hardware included. Stores in same space as one 2″ x 4″ piece of lumber.

Save time, space, and money in building storage racks, catwalks, supports, guard rails, special purpose tables, facilities. Call your Republic representative or write for idea-packed catalog.

For more facts Circle Reader Service Card numbers as follows:

MORE REPUBLIC STORAGE AND MATERIALS HANDLING PRODUCTS THAT SAVE MANUFACTURERS AND FABRICATORS TIME AND MONEY...

REPUBLIC WEDGE-LOCK LONG PARTS STORAGE UNITS are easy to load, unload from either side. The heavier the load, the tighter the grip because Wedge-Lock construction includes the three prime essentials of good shelving: 1. A post that will not bend; 2. A reinforced shelf that does not sag; 3. A concealed sway-proof joint. Republic Storage Engineering specialists help you plan. Write today.

REPUBLIC MATERIALS HANDLING SPECIALISTS engineered these steel boxes to the requirements of the Kropp Forge Company, Chicago, Illinois. Special features include corrugated construction for strength, smooth channel around the top to eliminate sharp edges, four-way fork channels to simplify handling, and stacking brackets to permit tiering to any practical height. For materials handling ideas that save space, time, and money, call Republic or send coupon.

TRUSCON "BUDGET BUILDINGS"... 3-WEEK DELIVERY from order to job-site! Here's top utility at lowest cost—the fast, easy way to provide industrial housing or to enlarge manufacturing facilities. Truscon "Budget Buildings" are available in widths of 32, 36, 40, 44, and 48 feet—12- and 14-foot heights, in any length necessary. Roofing, siding, windows, doors, hardware shipped as a package. Erection is fast, easy. Send for brochure.

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World's Widest Range of Standard Steels and Steel Products

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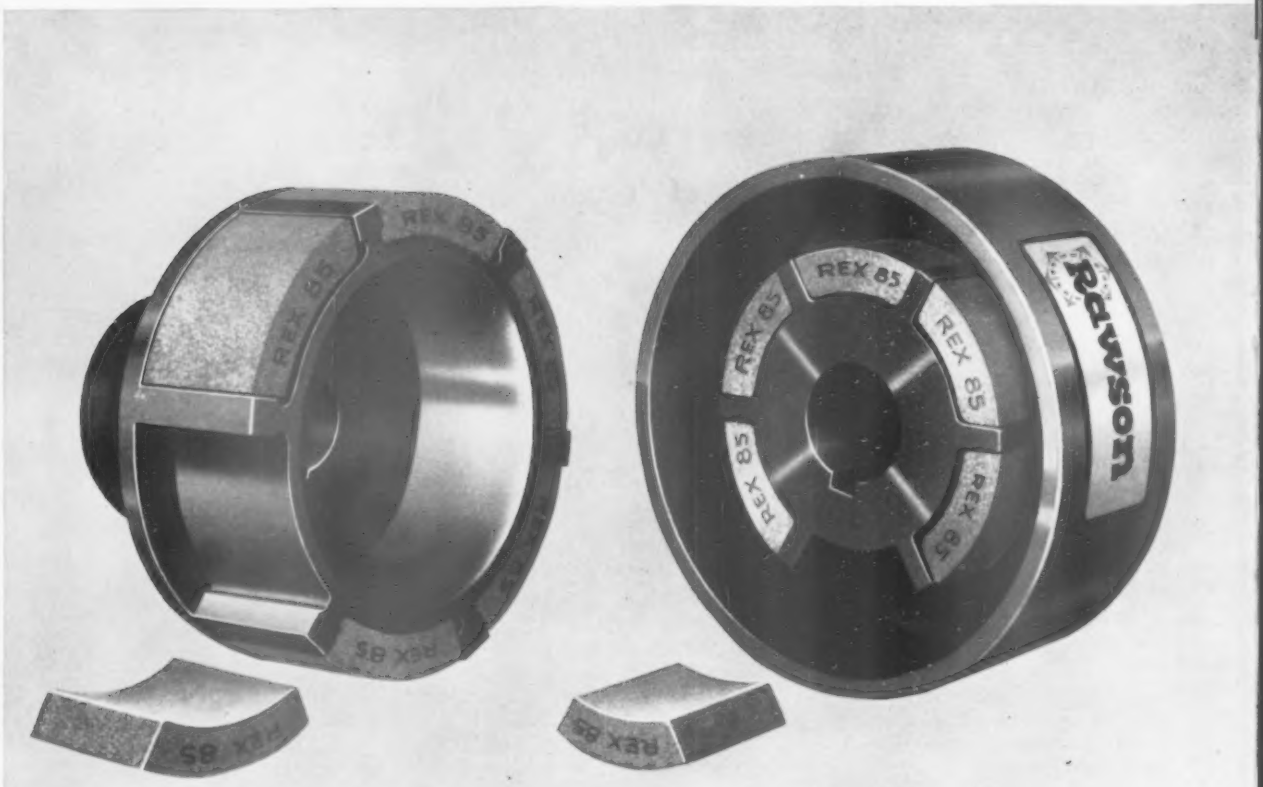
Please send information on the following:

☐ Republic METAL LUMBER ☐ Wedge-Lock Shelving
☐ Truscon "Budget Buildings"
☐ Have a Materials Handling Engineer call

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

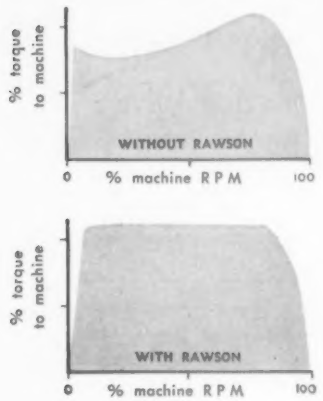
471 Buildings, 472 Shelving, 473 Metal Lumber, 474 Materials Handling Ideas.

For Cushioned

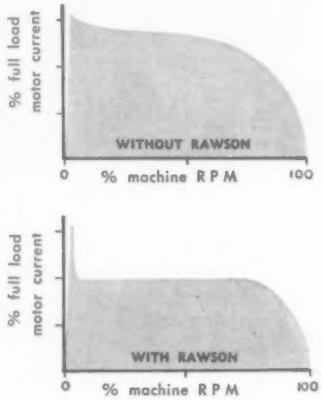


How Rawson Improves Motor Performance

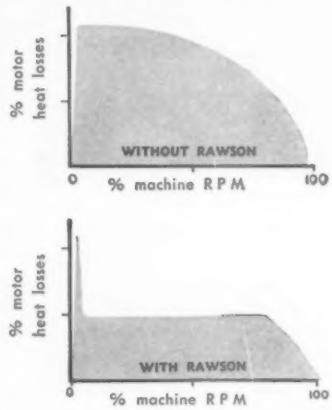
delivered starting torque



motor starting current



motor heat losses



"no load" Starts

Specify Rawson

Automatic Centrifugal Clutches and Clutch Couplings

Here is a major break-through in the development of automatic centrifugal clutches and clutch couplings! Rawson clutches and clutch couplings are designed with patented, exclusive metallic friction shoes instead of using fluid coupling devices or "brake lining" type materials. They deliver 100% slip-free power, provide full overload protection, permit smooth and gradual starting of high inertia equipment. This eliminates the need for costly special high torque starting motors and low-voltage starting equipment.

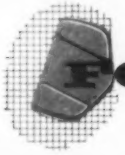
The segments, or shoes, in Rawson clutches and clutch-couplings are free-moving parts. As the driving half of clutch picks up speed, centrifugal force causes the shoes to contact the inside surface of the outer race, which is attached to the load or driven equipment. The shoes slip momentarily until friction at full speed causes the driven half to rotate in complete engagement with the driving half, both members then rotating as a unit without slippage or power loss. Jamming or overload of driven equipment causes clutch to slip — protecting motor against excessive overloading.

Rawson clutches and couplings drive in either direction and transmit up to 2,000 H.P. from nearly every motive source including A.C. and D.C. motors, diesel and gasoline engines or turbines. They function as direct couplings or as indirect drives through V-belts, chains or gearing and can be furnished with delayed shoe engagement for standby or dual drive units with load limit on starting or running. Rawson clutches and couplings are simple in design, fast and easy to install, entirely mechanical for trouble-free operation and they never require adjustment.

For increased efficiency, lower first costs, reduced maintenance and utmost protection even for the most delicate driving and driven equipment, specify Rawson clutches and clutch couplings. Ask your Rawson distributor or write us direct for your free copy of Rawson Catalog No. 141.

FORMSPRAG COMPANY
23609 Hoover Road, Dept. 101
Warren (Detroit), Michigan

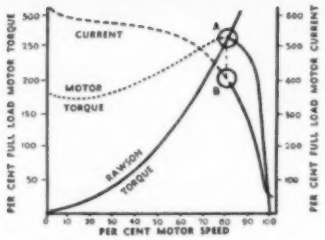
Distributorships available in selected areas. Write for details.



FORMSPRAG COMPANY

World's Largest Exclusive Manufacturer of Over-running Clutches

and Protects Motors

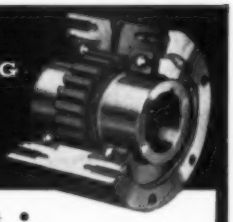


Using Rawson clutches or clutch couplings in a start-drive system lets you switch from costly high-torque motors to smaller standard, general-purpose motors for starting high-inertia loads.

Chart above shows how Rawson permits a standard NEMA "B" motor to start without load. The clutch does not fully engage until peak motor torque speed (A) is reached. Motor acceleration time is cut to a fraction of a second, decreasing the peak current period and allowing more efficient motor operation (B).

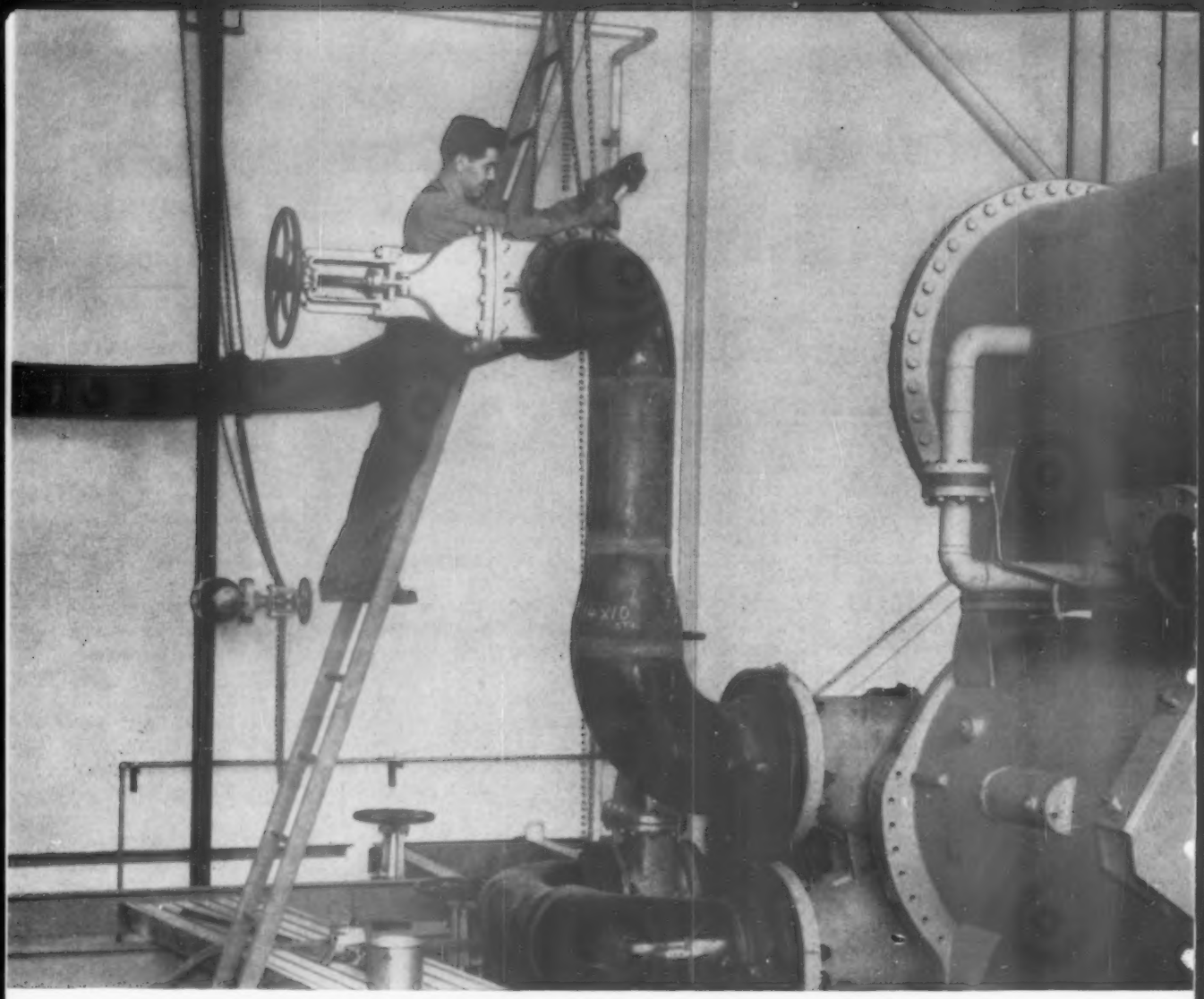
Thus, expense of reduced-voltage equipment is eliminated with the Rawson cushioned "no-load" starts, even on the heaviest machinery.

FORMSPRAG OVER-RUNNING CLUTCHES... UNIVERSAL APPLICATION!



OVER-RUNNING • INDEXING • BACKSTOPPING

Modern Formsprag sprag-type clutches are practically unlimited in power transmission applications. They are universally used in automotive, aircraft and general industries. Complete range of capacities from small clutches at 50 in. lbs. to large bore backstops up to 136,000 ft. lbs. Complete Formsprag standard line includes bore sizes from ⅜" to 12". Specials engineered to your requirements. Write for the new Formsprag catalog.



SPANG Steel Pipe carries corrosive Trichlorethylene for the Ford wind tunnel, where engineers conduct experiments in aerodynamics and radiator, ventilation, and air conditioning development.

SPANG Steel Pipe carries corrosive brine in Ford Motor Company wind tunnel

160°F above zero to −20°F . . . those are the conditions under which the Ford automotive testing wind tunnel operates. There can be no room for material or mechanical failure here.

In this installation, SPANG Steel Pipe carries corrosive brine in the refrigeration machinery, which produces extreme weather conditions for testing and developing radiators and air conditioning systems as well as aerodynamics testing.

SPANG Steel Pipe is manufactured under strict *quality-control* conditions and thoroughly tested and inspected to assure you of *top-quality* installations and performance.

For your next job: make it steel pipe . . . make it SPANG.

Plumbing Contractor:
James & Roach, Inc., Detroit, Michigan

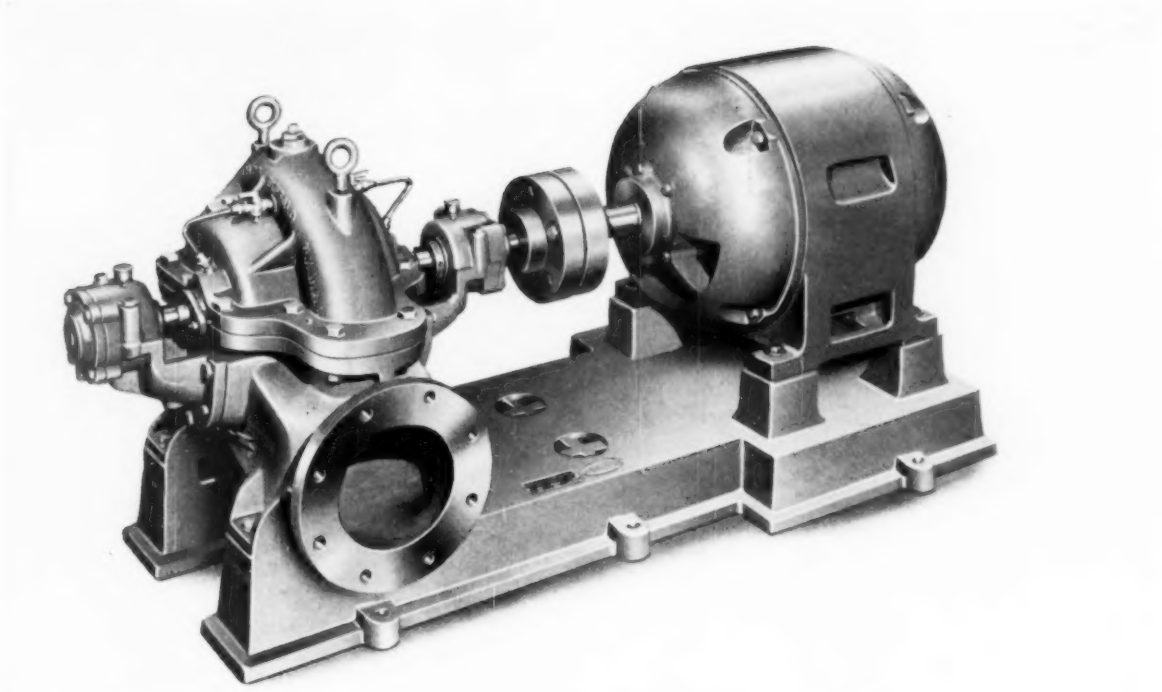
SPANG CW STEEL PIPE

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

For more facts Circle 476 on Reader Service Card



"Buffalo" Double Suction Pump for Clear Water Service

3-WAY ECONOMY

WITH THESE "BUFFALO" PUMPS

1. Minimum Maintenance Cost **2. Minimum of Costly Time-Outs**

3. Minimum Service Costs

"Buffalo" Double Suction Pumps bring you these and many more economies because they combine superior hydraulic design with the finest quality workmanship and materials.

Lower maintenance cost and fewer expensive time-outs are the result of these "Buffalo" construction features: sturdy, machined casing with ample, simply-formed water passages — hydraulically balanced impellers assuring peak efficiency — renewable bronze wearing rings — heavy-duty ball bearings and shaft is high grade steel, machined all over, bronze covered, or solid monel metal or other alloy.

Lowest possible service costs are assured by the extra accessibility designed into these pumps. Horizontally-divided casing permits quick removal of the upper half. Thus interior parts can easily be inspected or removed without disturbing pipe connections.

Add to these economies peak efficiency and dependability and you have a pump that is unsurpassed for the most severe industrial clear water service.

For full information on the "Buffalo" Double Suction Pump, contact your nearby "Buffalo" engineering representative. Or write for Bulletin 955-S.

"Buffalo" PUMPS

BUFFALO PUMPS

Division of Buffalo Forge Co.

471 BROADWAY • BUFFALO, N. Y.

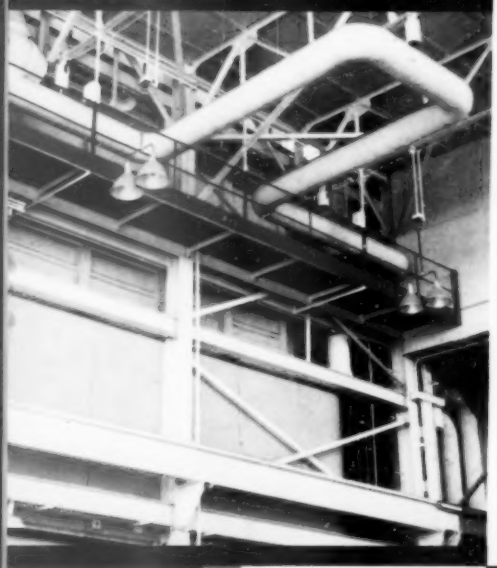
Canada Pumps, Ltd., Kitchener, Ont. • Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

For more facts circle 477 on Reader Service Card **For more facts circle 478 on Reader Service Card →**

Bright, modern, functional

COLORS



...another important **Difference** in the Rust-Oleum System

How many coating manufacturers offer you a *complete system* that Stops Rust—and provides lasting beauty over the years? The Rust-Oleum *System* does just that.

First—apply Rust-Oleum 769 Damp-Proof Red Primer directly over the sound rusted surface, after scraping and wirebrushing to remove rust scale and loose rust. The *specially-processed* fish oil vehicle in the primer penetrates rust to bare metal—merging the rust into the coating—saving costly surface preparations. *Second*—the wide variety of colors in Rust-Oleum finish coatings provides lasting beauty over the primer. Your choice of practically all colors from bright enamels to soft, restful pastels—all formulated for long over-the-years protection.

What is your coating problem? From Heat Resistant, Chemical Resistant, and Machinery Finishes to Heavy-Duty Top Coatings for use indoors and out—Rust-Oleum has the coating to meet your needs and the *system* for lasting beauty. Consult your Rust-Oleum Industrial Distributor . . . he has complete stocks for your use in maintenance, new construction, and remodeling. His experience can serve you well.

A matter of excellence.
Distinctive as your own fingerprint.

RUST-OLEUM®

STOPS RUST!®

RUST-OLEUM IS AVAILABLE IN PRACTICALLY ALL COLORS

SEE OUR CATALOG IN SWEET'S
OR WRITE FOR COPY

STOP RUST

with

RUST-OLEUM
769 Damp-Proof Red Primer

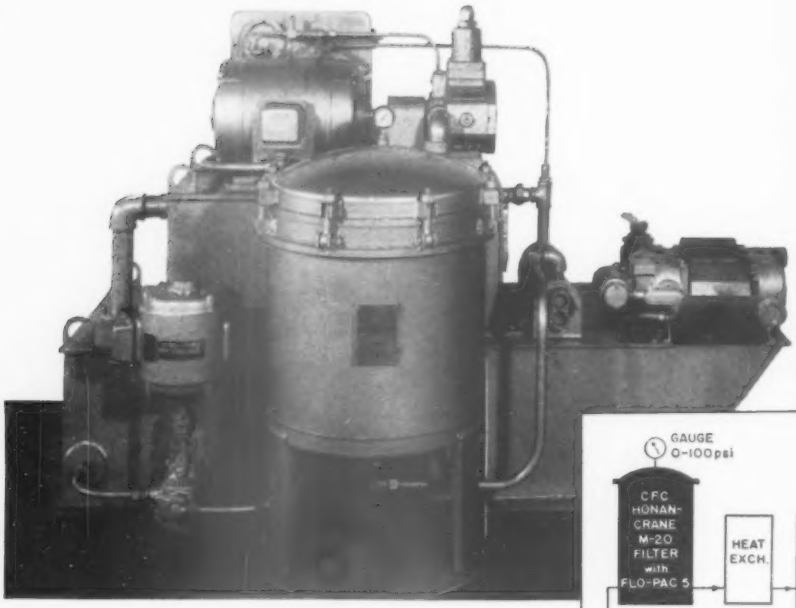
Eliminate costly surface preparations and save time, money, and metal. Just brush Rust-Oleum 769 Damp-Proof Red Primer right over the sound rusted surface—after scraping and wirebrushing to remove rust scale and loose rust. You can do this because the **specially processed fish oil vehicle** penetrates rust to bare metal—as proved by radioactive tracing studies.

SEND FOR FREE TEST SAMPLE! ATTACH TO YOUR LETTERHEAD!

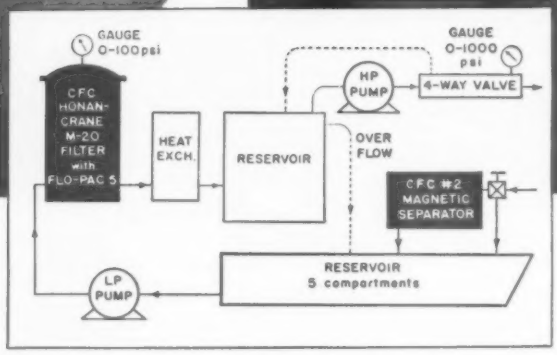
Rust-Oleum Corporation
2982 Oakton Street, Evanston, Illinois

Please send me the following at no cost or obligation:

- ☐ Free test sample of Rust-Oleum 769 Damp-Proof Red Primer for rusted metal surfaces.
- ☐ Complete literature with applications and color charts.
- ☐ Information on matching special colors.
- ☐ Thirty-page report on Rust-Oleum fish oil penetration.



This installation, designed and built for a leading electrical manufacturer by Hydro Air Engineering, Inc., St. Louis, Missouri, supplies mineral oil coolant, 90 SUS, at 600 PSI, to target drill. CFC Magnetic Separator removes ferrous contaminants. Oil then passes through compartmented reservoir to provide sedimentation of remaining particles. CFC Honan-Crane Filter then acts as polishing filter to take out contaminants not already removed.



"ON-TARGET" FOR REDUCED COSTS

Hydro Air Engineering, Inc. unit cuts downtime with CFC Honan-Crane Filters and Magnetic Separators

This Hydro Air Engineering, Inc. Unit assures reduced costs on target drill operation by keeping coolants micro-clean with CFC Magnetic Separator and CFC Honan-Crane Filter. Drill has extremely heavy chip load. By maintaining continuous supply of *clean* oil, CFC equipment protects the high pressure pump and valves, and prevents clogging of the drill ports. This means lower costs through reduced downtime, less tool breakage, and fewer rejects.

The low-cost CFC Magnetic Separator, with permanent Alnico magnets, removes ferrous chips automatically and continuously. It is compact, light-weight, easy to install. Unit includes totally enclosed gearhead motor. No separate pump is required.

The CFC Honan-Crane Filter employs the new Flo Pac 5 Cartridge — designed to remove 98% of all particles larger than 5 micron. Tough, resin-impregnated paper provides more than 6300 square inches of filtering surface, per cartridge.

For technical literature, or engineering assistance, write to Department FA

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

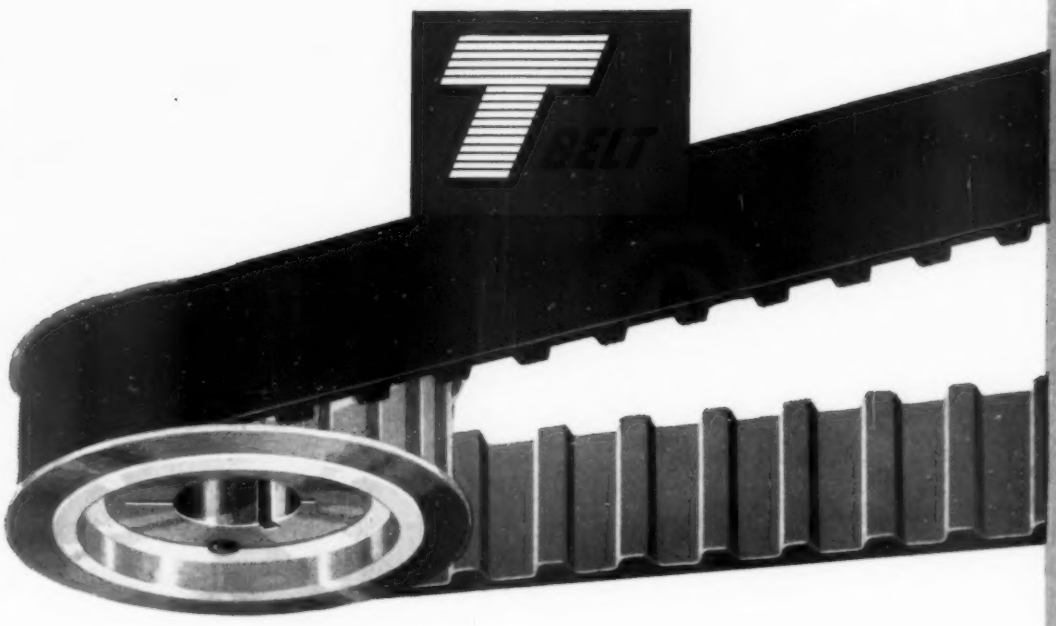
MICRO-CLARITY AT MINIMUM COST

Fulflo FILTERS — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC FILTERS — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

For more facts circle 479 on Reader Service Card

US PowerGrip



for No-Slip Drives

The U. S. PowerGrip "Timing"® Belt, a "U. S." invention, has been one of the true sensations in power transmission since it was patented eight years ago. Thousands of plants have converted drives to this more practical means of transmission. Its use has greatly increased the efficiency of industrial machinery and given rise to new appliances and original equipment by the score.

The "'Timing' Belt with Teeth" is known throughout industry as the "T" belt, a term as significant as the "V".

The U. S. PowerGrip "Timing" Belt gives positive, non-slip performance and requires no maintenance, no lubrication. And because this belt requires no appreciable tension at installation, it thereby prolongs bearing life. Your U. S. PowerGrip Transmission Distributor carries all stock sizes and can give you the benefit of his long experience in converting to the modern T.

• • •

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

Announcing

—AN ENTIRELY NEW LINE OF V-BELT DRIVES

NEW HIGH CAPACITY!

NEW SMALL SIZE!

MANY NEW SAVINGS!

Dyna-V is entirely new. In every detail, Dyna-V has been engineered to take advantage of today's great improvements in belt materials and metal alloys—resulting in V-belt drives that are sensationally compact.

Dyna-V is capable of handling up to three times as much horsepower in a given space. Dyna-V opens vast new possibilities for better, more economical machine design. And, in most instances *Dyna-V costs less!*

An entirely new high in strength and horsepower capability is packed into Dyna-V Belts. Cross section dimensions are substantially reduced—top width is much narrower. Dyna-V Sheaves are designed for these belts. Narrower grooves reduce face width—and weight. Costs are lowered. Smaller diameter sheaves and shorter center distances multiply savings.

Increased sheave strength for increased capacity is obtained through changes in design that utilize the full benefit of modern improvements in alloy metals. Dodge is noted for the superiority of its semisteel castings, to which now have been added ductile iron castings produced with the most modern electric furnace facilities.

Dyna-V Sheaves are equipped with Taper-Lock Bushings. The superiority of this mounting, patented by Dodge, is widely recognized. Taper-Lock's holding power is terriffic, yet it is "easy on, easy off." And Taper-Lock Bushings provide the additional advantage of interchangeability.

The benefits of Dyna-V go beyond compactness and initial low cost. Smaller sheaves reduce shaft overhang—increase bearing life. The dimensional stability of Dyna-V Belts (which are heat resistant, oil resistant, static conducting) solves the problem of belt matching. Every belt carries its full share of the load. The crowned top of Dyna-V Belts is a new concept in belt design. Combined with proved concave sidewall construction, it insures perfectly even load distribution between belt and sheave.

A complete bulletin on Dyna-V, including drive selection tables, will soon be ready. If you want one of the first copies, write us at once. Or see your local Dodge Distributor.

DODGE MANUFACTURING CORPORATION
400 Union Street, Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

DODGE Dyna V

Dyna-V Drives for capacities up to 50 horsepower are now available from stock, using the new belt cross section, "3V," and Dyna-V Taper-Lock Sheaves to match.

Dyna-V Drives for capacities up to 200 horsepower, using "5V" belts and sheaves will be available from stock in March. Larger sizes up to 1500 hp, with "8V" belts and sheaves, can be furnished on order.

COMPARISON, ILLUSTRATED ABOVE — 3 HP, 1750 RPM, 2.41 TO 1 RATIO

	BELTS		SHEAVES			CENTER DIS-TANCE	HP	WEIGHT (LBS.)	COST	
	Number	Size	O.D. Driver	O.D. Driven	Width				Per hp	Per Drive
CONVENTIONAL TAPER-LOCK DRIVE	3	A42S	4.15"	8.95"	2½"	12.3"	4.62	24.7	$5.91	$27.38
DYNA-V TAPER-LOCK DRIVE	2	3V400	3.35"	8.00"	1 3/32"	10.8"	5.0	18.0	$4.50	$22.50
% SAVING *Savings vary with different sized drives*			19%	10%	56%	12%	-+-	27%	23.8%	17.8%

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."

For more facts Circle 481 on Reader Service Card

You are looking at 14 gold-plated garbage cans

Special orders for the Texas-oilman trade? Guess again.

Fact is, each is priced *below* competition. The factory's turning out several thousand this month—for a new customer.

Unfortunately, the gold-plating doesn't show up on the product. Or anywhere else. It's concealed in a cloud of figures covering a month's operations for the whole factory. Weeks from today, somebody'll discover that the company lost money on the order . . . maybe even how *much* money. But now, the damage is done.

This story *could* have had a happy ending—with Automatic Keysort punched-card controls. A Keysort job-costing system could have computed a correct, profit-included selling price. The same system would have shown the plant manager how costs were running at each step of manufacture. He'd have spotted any impending loss *on time* . . . he'd have used his experience and know-how to eke out a profit.

Automatic Keysort is today's only data processing system that provides a family of integrated machines and methods designed for the automatic creation and processing of original records. Speeding vital day-to-day and long-range facts essential to sound management, this unique system fits easily into your present operations...is highly flexible to future growth and expansion.

With the Automatic Keysort System, manufacturing concerns of every size can now enjoy fast, accurate data processing on either a centralized or decentralized basis. Without restrictive, complex procedures. Without specialized personnel. And at remarkably low cost.

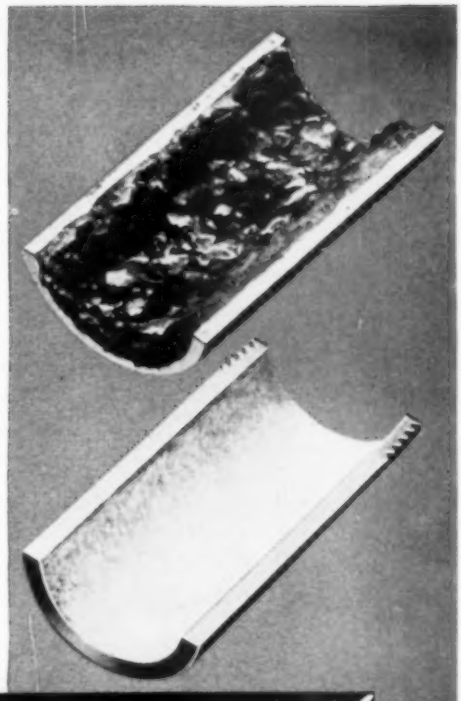
Call your nearby Royal McBee Data Processing Representative, or write Royal McBee Corporation, Data Processing Division, Port Chester, N. Y. for illustrated brochure F-2.

ROYAL McBEE · *data processing division*

NEW CONCEPTS IN PRACTICAL OFFICE AUTOMATION

For more facts Circle 482 on Reader Service Card

this is no pipe dream...



Here are two sections of water pipe, one dangerously rusted and corroded. The other, protected by Sudbury AQUA-CLEAR, has remained clear and clean through long, continual use.

Rust and corrosion are constantly eating away every pipe line in your plant, and you know that repairs are extremely costly in both labor and materials, as well as shut-down time.

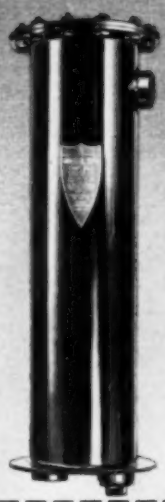
Sudbury AQUA-CLEAR Solves Rust and Corrosion Problems

AQUA-CLEAR Feeders have been successfully used in processing and refrigeration plants where raw sea water is used for condenser cooling. This is important to remember because flowing sea water presents a much more difficult rust and corrosion problem than fresh water.

Patented AQUA-CLEAR Feeders are protecting millions of dollars worth of plant equipment in diversified industrial operations throughout the world...air conditioning installations, food processing plants, paper mills, steel plants, water cooling towers and many others.

In fact, any plant where water is used for processing... and where rusty water is causing trouble... can solve their problems with AQUA-CLEAR. Even keeps drinking water free of rust, crystal clear. AQUA-CLEAR is potable, odorless, non-toxic.

- AQUA-CLEAR Feeders can be installed quickly and inexpensively. Economical to maintain, have no moving parts, automatic in action. Over 50,000 now in use.
- AQUA-CLEAR is used in two forms: Liquid Aqua-Clear, for use in tanks or closed systems; and Aqua-Clear Crystals, automatically proportioned in the Aqua-Clear Feeder installation at intake. Mail coupon for more information.



Write today for latest bulletin about patented AQUA-CLEAR protection. If you have a specific problem, mention it and we'll tell you of similar situations we have successfully met.

SUDBURY LABORATORY

Box 73N **Sudbury, Mass.**

MANUFACTURER OF QUALITY PRODUCTS FOR OVER A QUARTER CENTURY

Regional Representatives Thruout the United States and Around the world

SUDBURY LABORATORY, Box 73N, Sudbury, Mass.

Please send complete information on uses of the AQUA-CLEAR Feeder system in my industry for the prevention of rust and corrosion.

Name .....

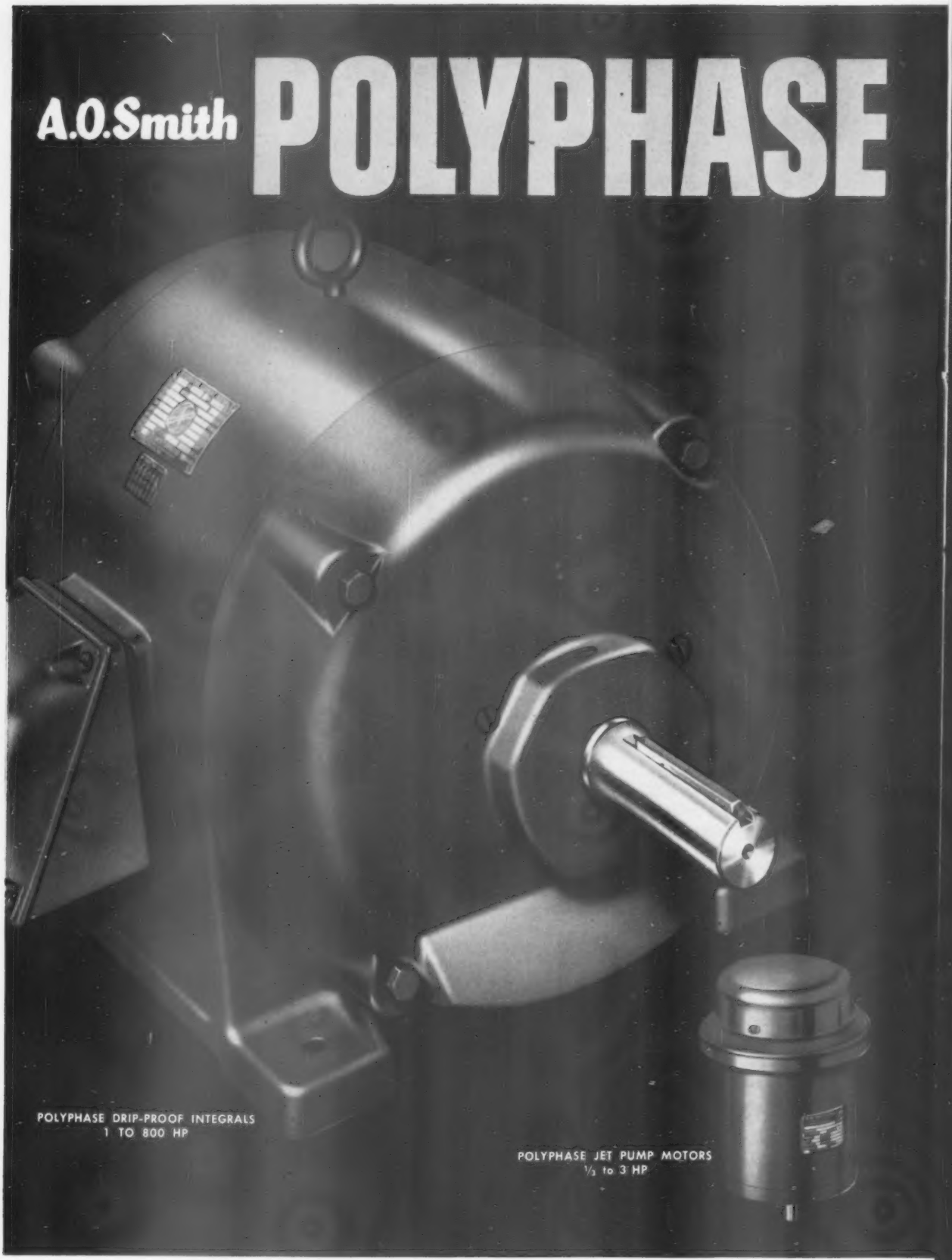
Company .....

Street .....

City ..... Zone .... State .....

Our corrosion problem: .....

.....


A.O.Smith POLYPHASE
POLYPHASE DRIP-PROOF INTEGRALS
1 TO 800 HP
POLYPHASE JET PUMP MOTORS
½ to 3 HP

MOTORS

1/3 to 800 hp

YOURS from the case of the A. O. Smith motor man

POLYPHASE FRACTIONALS 1/3 to 1 HP
rigid or resilient bases

VERTICAL HOLLOW SHAFT POLYPHASE
INTEGRALS 1 to 700 HP

VERTICAL SOLID SHAFT POLYPHASE
INTEGRALS 1 to 800 HP

TEFC and EXPLOSION-PROOF POLYPHASE
INTEGRALS 1 to 500 HP

CLOSE-COUPLED POLYPHASE PUMP
MOTORS 1 to 150 HP

Here's what amounts to "supermarket" variety — eight basic types of polyphase motors, each available in a wide range of sizes and with practically any electrical or mechanical modification needed.

But in addition to wide choice that helps you get the motor best suited for your application, you get scores of quality features that pay off in uninterrupted service, longer operating life, lower maintenance cost. Every motor is designed to offer ample protection against temporary overloads or voltage drops. You get balanced insulation to afford maximum protection against phase-to-phase or phase-to-ground breakdowns during high amp surges.

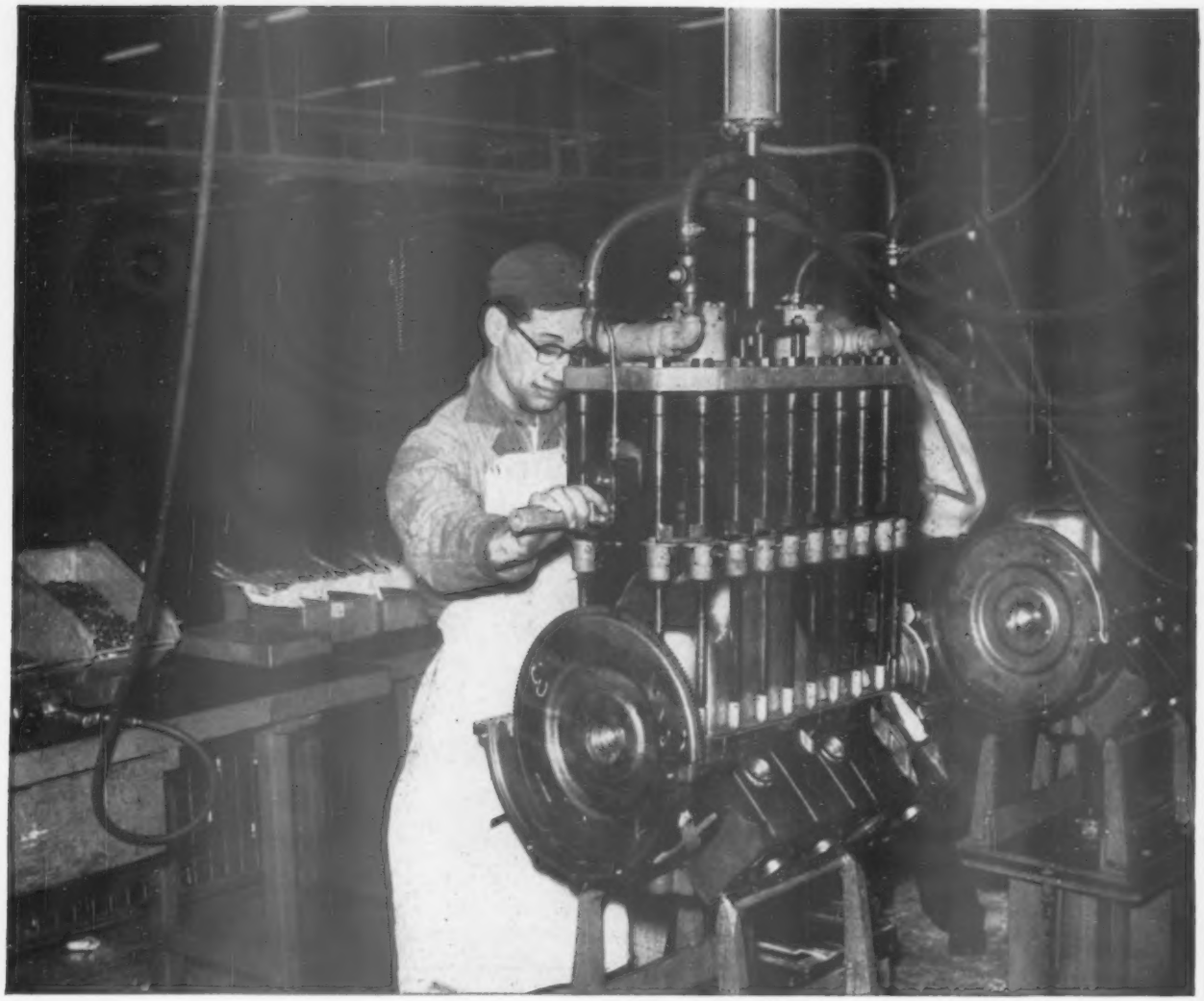
All the engineering assistance you want or need is available for designing a motor into your product or applying standard models. What's more, many models are available from stock, in both old and current NEMA frame sizes.

Why not contact your A. O. Smith motor man now? Write for Bulletin EM-159 or refer to Sweet's Catalog to get the complete story on fractionals as well as A. O. Smith's complete line of integrals and hermetics—1/3 to 800 hp.

Through research ...a better way

A.O.Smith
CORPORATION

ELECTRIC MOTORS
Tipp City, Ohio
A. O. Smith International S. A., Milwaukee 1, Wisconsin, U. S. A.



R/M Homoflex Hose is Strong, Light, Flexible... Easier Handling... Lasts Longer

The unique construction of Homoflex Hose adds up to *real* labor and costs savings wherever air, water, and other fluids and gases are handled. It's strong, yet light in weight and "flexible as a rope". Because it's mandrel-made with no pre-set twist, Homoflex coils and uncoils freely in *any* direction *without* kinking! A homogeneous construction, strength member and tube are virtually inseparable, even under the most severe conditions of use around the plant. Mandrel-made also provides uniform inside and outside diameters for faster, easier, *safer* coupling.

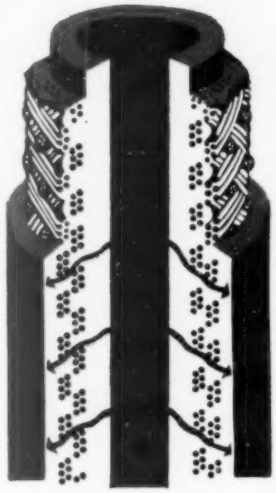
Homoflex Hose reduces hose costs because it does a better job and it lasts longer. Ask your R/M representative about Homoflex and other types of R/M hose for factory use. He'll show you why R/M constructions assure "More Use per Dollar" on every job.

For more facts Circle Reader Service Card Numbers as follows:

ONLY R/M OFFERS

HOMOFLEX

CONSTRUCTION



- Super-Strong
- Precision Built
- Flexible as a Rope
- Light Weight

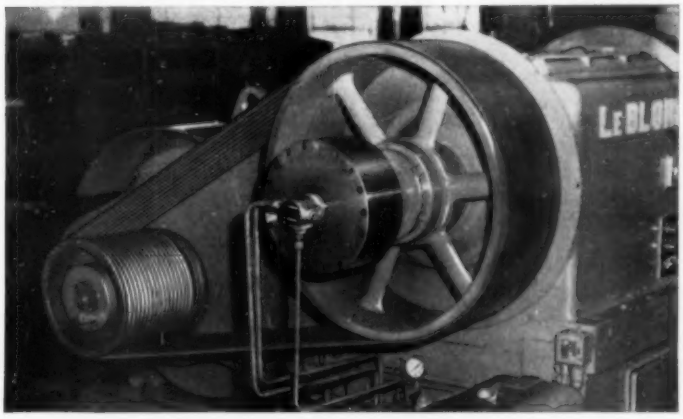
Weighs less than any other hose of equal working pressure.

Note in cross section how specially designed braid permits the rubber tie-gum to penetrate and bond the braided plies during the plastic stage of vulcanization. This results in an inseparable tube-to-cover bond. Write for Bulletins M694 and M610.

"More Use per Dollar"

RAY-MAN CONVEYOR BELT CUTS HANDLING COSTS

Industry's *only* compensated conveyor belt relieves stress of outer plies—both top and bottom—to assure longer life and lower costs for handling bulk materials. Ray-Man troughs easily and trains naturally . . . has the strength and flexibility to carry full loads even where relatively thick, narrow belts are used over small pulleys. Holds fasteners under most severe conditions . . . requires no breaker ply . . . protected against wear, tear, cuts and abrasions with exclusive "XDC" Cover! Write for Ray-Man Bulletin M302 and bulletins on other R/M belts for a wide variety of applications.



R/M POLY-V® DRIVE—*MORE* POWER IN *LESS* SPACE

This patented new power transmission drive features a *single, endless* parallel V-ribbed belt running on sheaves specially designed to mate precisely with the belt ribs. The results? The highest horsepower capacity per inch of drive-width yet possible . . . up to 50% *more* power delivery in the *same* space as a conventional V-belt drive—or *equal* power in as little as ⅔ *the space!* Single unit belt design eliminates belt "matching" problems . . . assures constant belt speed ratios from *no* load to *full* load to provide the smoothest running, coolest running—*longest wearing* drive for your power driven equipment. Just *two* cross sections of Poly-V* Belt meet *every* heavy duty power requirement. Write for Bulletin M141.

*Poly-V is a registered Raybestos-Manhattan trademark.

RMD19

BELTS • HOSE • ROLL COVERINGS • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products: Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

516 Poly V-Drives, 517 Hose, 518 Conveyor Belt

USERS OF **NEW** **ROEBLING HERRINGBONE* WIRE ROPE** HOLD THESE TRUTHS TO BE SELF-EVIDENT.....

That Herringbone is the most practical and *needed* wire rope development to come along in years.

Herringbone, the regular lay and Lang lay rope, is actually two-ropes-in-one rope. Thus, the qualities that make these two ropes *good* ropes, combine to make Herringbone *excellent.*

HERE'S WHY:

The steel core of Herringbone provides the *ideal* support for the two pairs of Lang lay and one pair of regular lay strands used in its construction. In addition, the outer wires are heavier for extra abrasion resistance, and good flexibility is maintained by the finer wires inside. This combination of features enables Herringbone to give *longer service* in most applications.

Herringbone has been used on a wide variety of excavating equipment and tough hoisting jobs with impressive results. Its applications are practically unlimited on installations which call for all-steel ropes and on many where fiber core ropes are now being used. Another of Herringbone's added attractions is the fact that it eliminates the necessity for stocking Lang lay rope for one job and regular lay for another.

Your Roebling Distributor has Herringbone right now. He has, also, copies of a brochure describing Herringbone, the newest Roebling Star Performer. If you wish, write Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, for literature and anything you'd like to know about Herringbone.

*Reg. App. For

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

HERRINGBONE
WIRE ROPE

For more facts Circle 486 on Reader Service Card

DURACO® VINYL INDUSTRIAL TILE

Built to take GREASE

Every industrial floor should be able to resist greases and oils commonly used in most manufacturing operations. Duraco does this superlatively well — because it's made with a *vinyl resin* binder that is unaffected by petroleum products.

This remarkable industrial flooring is built to perform better in plant or factory. It's grease-proof and acid-resistant — easier and safer to walk and work on, much easier and quicker to clean. It's designed to cut floor costs per square foot per year in your plant. Let Duraco prove itself in your plant without obligation to you. Our representative will be glad to discuss the details of the Duraco Test Area Program with you.

SPECIFICATIONS

Available in 5 terrazzo colors, 5 marbleized colors — coordinated with accepted industrial color standards. Size 9″ x 9″. Thicknesses: Standard Gauge 3/32″ — Heavy Gauge ⅛″.

AZROCK FLOOR PRODUCTS DIVISION
UVALDE ROCK ASPHALT CO.
501 FROST BANK BLDG. • SAN ANTONIO, TEXAS

AZROCK FLOOR PRODUCTS DIVISION
501 Frost Bank Bldg. San Antonio, Texas

We are interested in Duraco. Please have your representative call to discuss the Test Area Program with us.

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Gulf makes things run better, with—

NEW GULFCROWN

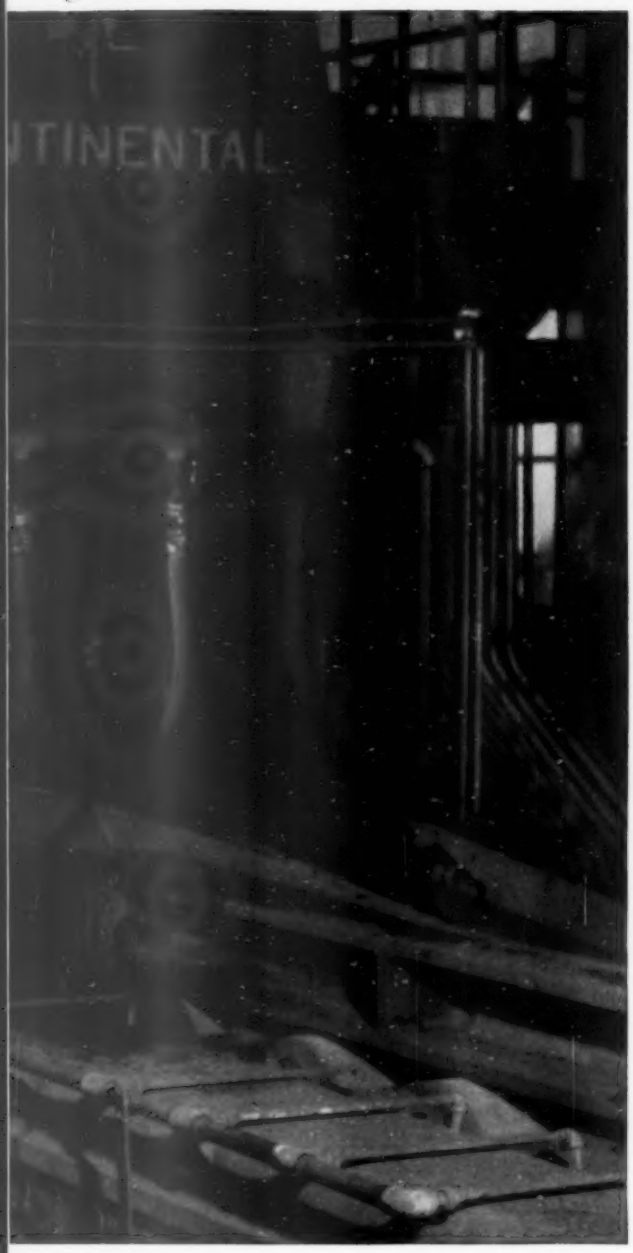
Here's a multi-purpose lithium base grease for bearings in heavy duty service.

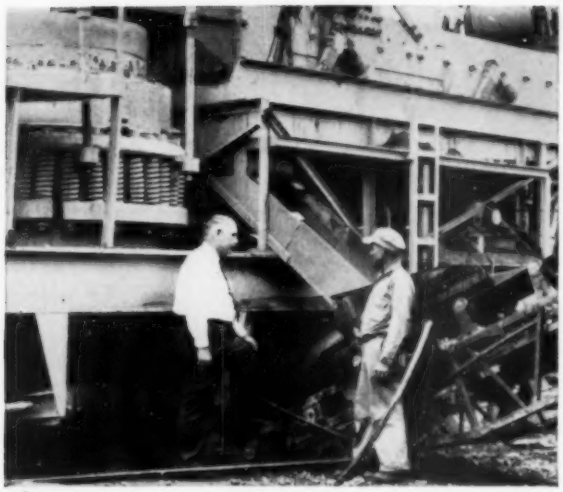
It's a completely new bearing grease that effectively lubricates bearings operating under high loads, shock loads and with oscillating motion.

New Gulfcrown Grease E.P. will give you plenty of proof that Gulf makes things run better. It resists heat, cold, moisture and mechanical breakdown. It has excellent oxidation stability and protects against corrosion.

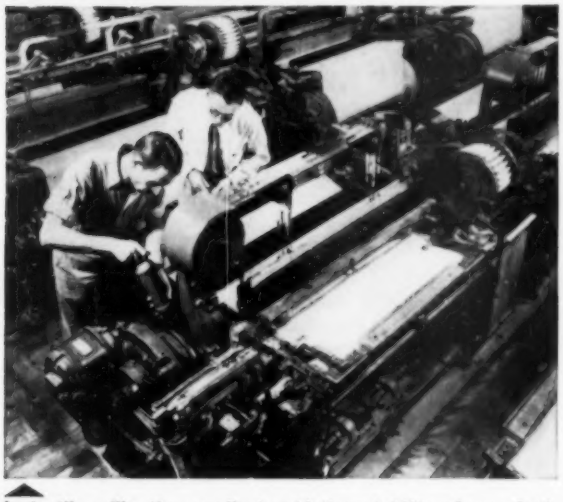
You'll find that this new grease pumps freely at 0°, yet stands up at temperatures to 250° F., and even higher under certain conditions.

New Gulfcrown E.P. is an unusually versatile multi-purpose grease. For example, it gives excellent results in the lubrication of heavily loaded trunnion bearings . . . steel mill work rolls and table rolls . . . sliding dog clutches . . . spiral gear boxes . . . Banbury mixers . . . the bearings, cams and gears in textile looms . . . and





In hard-working equipment, like stone crushers, new Gulfcrown Grease E.P. withstands extremely high shock loads in grease lubricated bearings.



In textile mills, the excellent oxidation stability of new Gulfcrown Grease E.P. makes it the ideal lubricant for loom bearings, cams, pick balls and gears.

In steel mills, new Gulfcrown Grease E.P. will successfully withstand the high temperatures and extreme pressures encountered in the lubrication of work rolls and table rolls.

GREASE E.P.

a host of other heavy-duty industrial applications.

Gulfcrown E.P. can be used for electric motor bearings, fans, pumps and for nearly every type of application. Can be applied through centralized systems or by gun. Available in NLGI consistencies 0, 1 and 2.

Find out how Gulfcrown E.P. can improve your operation and help you get lower maintenance costs. Call your Gulf Sales Representative at the nearest Gulf office. Meanwhile, mail coupon for new booklet.

GULF

GULF OIL CORPORATION
Dept. DM, Gulf Bldg., Pittsburgh 30, Pa.

Please send booklet on new Gulfcrown Grease E.P.

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

FMM-5209

For more facts Circle 488 on Reader Service Card

YOUR ELECTRIC TRUCK BATTERY

Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Up to 44% more power. New Exide-Ironclad Batteries with armored porous tubing pack more power in the same size. So you can boost the work capacity of your present trucks, large or small—do more work. Or get the same power in a smaller size. Either way, you get longer life potential and more power per dollar for greater battery economy.

50 YEARS AGO, EXIDE PATENTED THE TUBULAR PLATE BATTERY

Exide was already 21 years old when it launched the Exide-Ironclad Battery—back in 1909. But the idea of the tubular positive plate was brand new. It was especially designed for electric truck service. Would it really give the longer battery life Exide engineers expected? Would it make possible greater battery economy? Look at the results.

Against every other type of battery—in every type of industrial truck application—in all kinds of heavy duty service, nothing has been found to match the Exide-Ironclad. A recent survey revealed that 91% of truck owners who have used Exide Batteries still use them. Once they experience the advantages Exide Batteries offer, they seldom buy any other brand. No other battery approaches this record of user satisfaction.

Today, of course, the Exide-Ironclad Battery is 50 years better than it was in the beginning. Exide engineers have constantly improved it. They have learned the secrets about tubular plate construction that only experience could teach—secrets about casting the lead grids, formulating grid alloys, composition of active material, filling the tubes, performance of tubing (about 20 different types were tested over a 15-year period before the last change). So the new Exide-Ironclad Batteries give today's buyer greater life and economy than ever before.

For more details on the new Exide-Ironclad Batteries, write for a copy of the 8-page, illustrated Brochure #6230

Today's advanced-design electric industrial trucks yield their greatest economy and productivity when teamed with the new, more powerful, Exide-Ironclad Batteries.

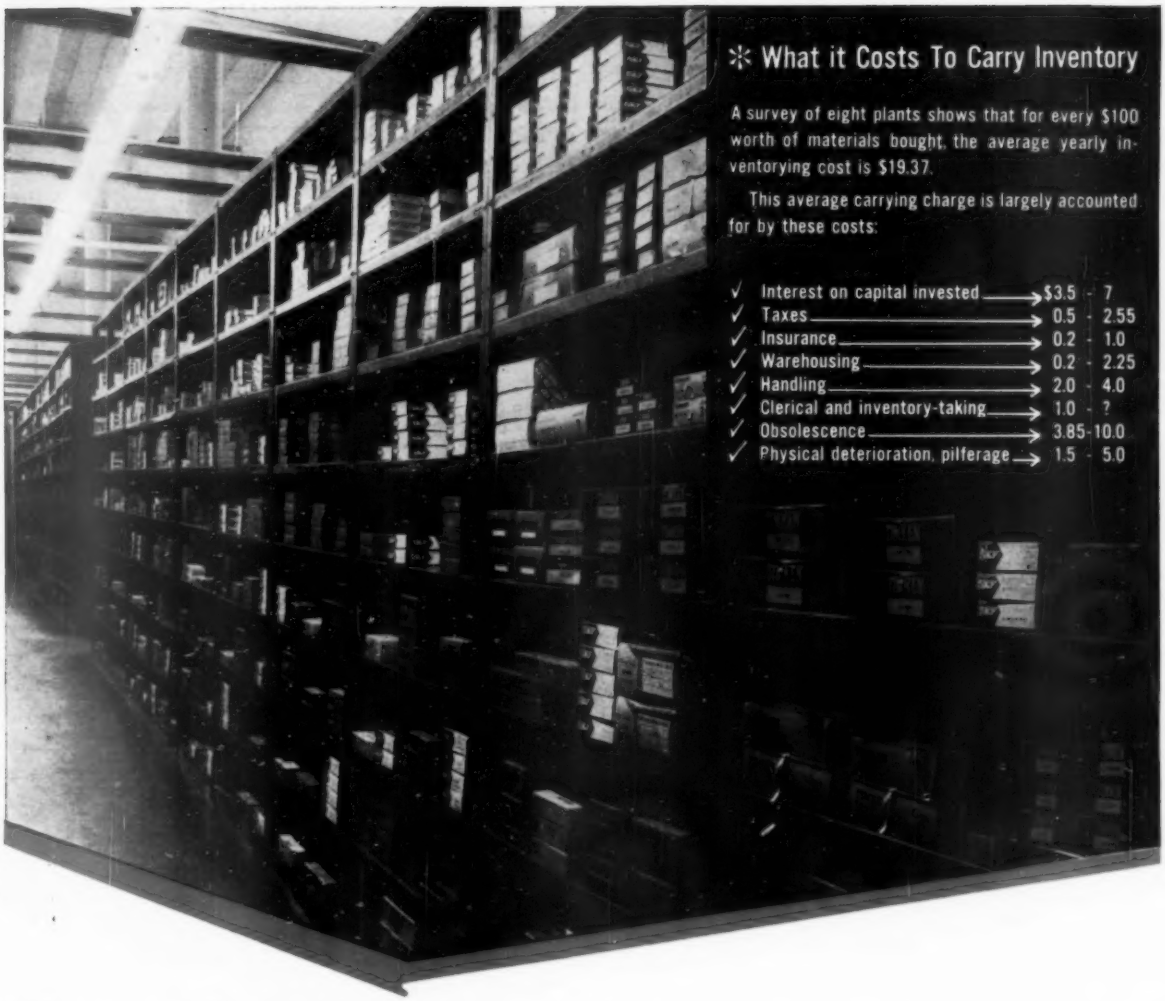
Now—get your chargers from Exide too

A complete line of chargers for electric truck batteries. New vertical-design motor generator chargers feature downdraft cooling for cleaner operation. Save ⅔ on floor area mounting space required. Can also be wall mounted. Simplified design and standardized construction make possible significant parts economies which are passed on to you. With Exide as your single source for both batteries and chargers, you are assured of better value, better performance and better service. *Write for new brochure giving complete information.*

Exide®

FACTORY

For more facts Circle 489 on Reader Service Card



✻ What it Costs To Carry Inventory

A survey of eight plants shows that for every $100 worth of materials bought, the average yearly inventorying cost is $19.37.

This average carrying charge is largely accounted for by these costs:

✓ Interest on capital invested	$3.5 - 7
✓ Taxes	0.5 - 2.55
✓ Insurance	0.2 - 1.0
✓ Warehousing	0.2 - 2.25
✓ Handling	2.0 - 4.0
✓ Clerical and inventory-taking	1.0 - ?
✓ Obsolescence	3.85-10.0
✓ Physical deterioration, pilferage	1.5 - 5.0

Bearings, Inc. can cut your costs on bearing inventory . . . 2 ways!

Inventory costs soak up a lot of dollars that could do much more for your company in other ways. We now perform inventory cost-cutting services for many of our customers and are ready to do the same for you.

First, a bearing survey of the bearings used in the equipment in your plant. We convert manufacturers' parts numbers to bearing numbers. This survey usually shows many identical bearings being held in inventory for different equipment when only one or two bearings will satisfy your immediate needs. A complete record is made of all bearings you actually require and we keep this record up-to-date.

Second, you keep in inventory only a minimum number of bearings to take care of emergencies. Bearings, Inc. guarantees that the branch nearest your plant will stock all the bearings shown on your survey, ready for immediate delivery day or night!

Call or write for a Bearings, Inc. sales engineer to discuss this important, money-saving program NOW! Check our branch locations for the one nearest you.

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WEST VIRGINIA: Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden
NEW YORK: Buffalo, Bolanrol Corp. • **MARYLAND:** Baltimore • **DELAWARE:** Wilmington

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N. CAROLINA: Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville • Nashville

How to avoid alloy steel failures

Ordinary precautions may protect you most of the time. But your luck could run out—and a single alloy steel failure can result in serious loss.

That's why the *extra* precautions of the Ryerson Certified Alloy Steel Plan are important to you. Under this plan you know three vital facts about the alloy steel you order from Ryerson stock:

- **Heat identification . . .** not just type identification, but the positive identification of your particular heat of alloy which has been spark-tested and separately racked to eliminate the possibility of mixed steels.
- **Chemical analysis . . .** not just the chemical range for the type, but the specific analysis of the heat from which your steel was rolled—keyed to your steel's identification.
- **Hardenability . . .** not just the average hardenability for the type of alloy, but the actual test-proved hardenability of your particular heat of steel, as-quenched and at three draw temperatures.

As a result, you can be sure of the steel you get from Ryerson—sure of what it will do . . . and sure of how to heat-treat for desired properties.

This extra protection is yours at no extra cost. So call your nearby Ryerson plant for every alloy steel requirement—and be sure.

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For more facts Circle 491 on Reader Service Card

FACTORY . . . PRESS TIME REPORT • FEBRUARY 1959

Looking Ahead in Business

Almost every important indicator of economic activity, except for manufacturing employment, is back to or close to previous high marks.

Gross national product (in 1958 dollars) is forecast at an annual rate of $458-billion in 1959's first quarter against the previous high of $454-billion in 1957's second quarter. FRB's Index of Factory Production is estimated at 144 for January, only two points below the peak of 146 (February 1957). Per-capita income after taxes (in 1958 dollars) is only $25 below the second-quarter peak of $1844.

•

Employment in manufacturing, particularly in hard-goods manufacturing industries, is the exception to the rule of general recovery in business.

Manufacturing jobs were below 15.7-million in December 1958. That's 7% below the July 1957 figure, commonly called the peak of business activity.

The lag of employment behind general business recovery is not a new development. Gains in factory jobs lagged behind the business recoveries after the two other postwar recessions. Not only do factory jobs lag behind general business recovery, but in each of the three postwar recovery periods the rise to new highs (or near highs) for factory jobs has taken considerably longer.

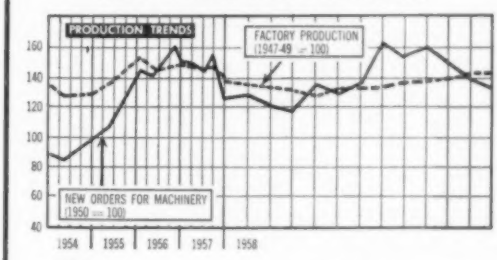
•

After the 1949 recession factory jobs took only 10 months to return to prior peaks. After the 1954 decline they took much longer—after 15 months of general recovery factory jobs had recovered only four-fifths of the earlier drop.

In the current recovery both manufacturing employment and, surprisingly, non-agricultural jobs are lagging far behind.

After eight months of general business pick-up since April, manufacturing jobs have made up only one-fourth of their earlier decline, with durable-goods jobs recovering about one-third of the way. Even non-agricultural jobs are not gaining as rapidly as in earlier recoveries. They are running only a little over 1% higher than at the recession low.

FACTORY FIGURES OF THE MONTH



Indicator	Dec. 1958[p]	Nov. 1958[r]	Dec. 1957
New Orders for Machinery (exc. elec.)[1]	134.0	140.0	122.0
Contracts for Industrial Construction[2]	71.0	72.0	80.0
Factory Production[3]	144.0	144.0	137.0
Consumers' Prices (cost of living)[4]	124.0	123.9	121.6
Industrial Prices (materials, supplies)[4]	127.2	126.8	126.1
Manufacturing Employment (millions)[4]	15.7	15.7	16.3
Total Employment (millions)[5]	64.0	64.7	64.4
Unemployment (millions)[5]	4.1	3.8	3.4

[p] = preliminary [r] = revised

Sources: 1. McGraw-Hill Dept. of Economics (1950 = 100); 2. Engineering News-Record (1950 = 100); 3. U. S. Federal Reserve Board (1947-49 = 100); 4. U. S. Dept. of Labor, Bureau of Labor Statistics (1947-49 = 100); 5. U. S. Dept. of Commerce, Bureau of the Census.

Recent gains in manufacturing production are due more to rising productivity than to an increase in jobs or a gain in working hours.

The rate of increase in productivity since April is estimated at over 6%. Hours of work of factory employees have increased less than 5% over the same period. And factory jobs are up less than 3%.

•

The outlook for manufacturing jobs during 1959 is not rosy. A rise in factory jobs will take place over the year, but slowly. It will take at least another 10 months for such jobs to get back to the pre-recession level. And it will take even longer for factory employment to reach the high point attained in 1953.

Company people are saying that one good result of the recession is that firms have cut the "fat" out of operations, laid off some workers permanently. But rising output will draw many of them back.

Ideas of the Month

(For more information, circle item numbers on Reader Service Card next to back cover)

You busy? Like to reach people in a hurry? Then you'll go for the Quick-Call direct-line system (*Automatic Electric*). Just poosh a button to get any one of up to 20 pre-selected P-A-X or P-A-B-X stations. **(312)**

Never a cracked skull with new pendant-type pushbutton station (*Joy*). Two-piece housing is one-third the size of conventional cast-iron unit, weighs less, costs less, too. Water-, rust-, corrosion-proof. **(313)**

Now hear this, all you 3-D layout enthusiasts: Piping components (*Industrial Models, Inc.*) of injection-molded styrene now available—200 different items. Extruded pipe in nine sizes, four colors. **(314)**

Aluminized flame-proofed rayon used in new protective clothing (*Wheeler*) is reported to be six times as strong as aluminized duck. **(315)**

Hi-Hoist (*Lantz*), for overhead maintenance work, goes to job in three sections; hoists to 13 ft.; lifts materials weighing up to 100 lb.; keeps tools and materials at work level; saves trips up and down ladder. **(316)**

Throw away those tweezers! Vac-U-Grip tools (*Carman Labs*) will handle teeny, fragile parts faster, easier, more accurately. **(317)**

Newest V-belt drive (*Gates Rubber*) has narrower belts, narrower sheaves; packs up to three times the horsepower capacity in same space. Savings in over-all cost are estimated to run as high as 20%. **(318)**

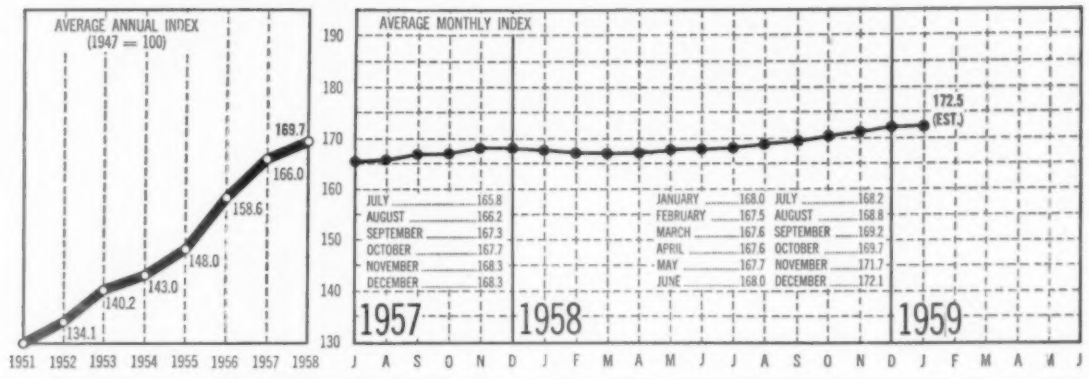
If handling is one of your job responsibilities, be sure to add revised edition of "The Basic Concepts of Industrial Material Handling" (*Material Handling Institute*) to your working library. **(319)**

Treat your safety people to one of those 8-position stretcher-chairs (*Ferno*). Weigh only 30 lb.; roll on two ball-bearing wheels. Adjustable chair back for patients who need to sit up in ambulance. **(320)**

For modernizers there's a mighty helpful booklet (*Allis-Chalmers*) called "59 Ideas for Modernization in '59." **(321)**

More Ideas of the Month on pages 164 and 165

Cost Index of Plant Maintenance



Index Gains 1.8% in '58

Index should be about 4% higher in 1959, with costs of wages and materials moving up

FACTORY'S Cost Index is estimated at 172.5 for January—an increase of 0.4 percentage point over the end-of-1958 level. The December figure, in turn, was 0.4 percentage point above November. Most of this gain was in rising labor costs. Of the 39 materials for which cost data are gathered, only 9 cost more in December than in November, 7 cost less, and 23 held at exactly the level of the previous month. In 1958 the Index rose by only 1.8%. The 1957 gain of 4.9% was almost three times the 1958 rate of increase.

This year the Index is expected to increase at a faster pace than in 1958 but more slowly than in 1957. Trends in wages and materials suggest that the Index will run about 4% higher in 1959 than in 1958.

Higher maintenance and production costs should not be as great a burden to plant managers this year as they have been during the past two years. The reason: Plant productivity is increasing more rapidly than in recent years—and will more than offset increased costs in 1959. This means that profits, before and after taxes, will be higher in the year ahead than they were in 1957 and 1958. In fact, there is a good chance that the level of profits in 1959 will reach an all-time high.

Note—Figures for lubricants (table, right) reflect a new way of computing lubricant costs. For explanation, see article on page 79 of this issue. (Charts at top do not show revised figures.)

	AVERAGE 1958	DECEMBER (Preliminary)	NOVEMBER (Revised)
Building and Facilities Index	169.7	163.7	163.6
Materials	139.1	141.2	141.0
Brick	148.8	150.5	149.5
Elec. fixtures	128.9	128.9	128.9
Elec. switches, boards, fuses	181.5	180.7	180.8
Elec. wire, copper	122.5	130.6	130.6
Glass	152.2	152.0	151.5
Gutters, spouts, ducts	172.9	178.8	178.8
Gypsum products	139.8	140.8	140.8
Heating equipment	127.4	127.7	127.4
Lumber	124.9	126.9	127.2
Millwork	146.9	149.5	149.5
Paint	130.1	130.0	130.0
Pipe, cast iron	170.4	170.4	170.4
Pipe, steel	192.0	192.7	192.7
Pipe & tubing, copper	145.7	150.9	148.5
Roofing	120.4	126.4	126.4
Sanitary fixtures	145.0	147.8	147.8
Sash, metal frame trim	146.9	145.2	145.2
Solder	117.5	122.3	122.5
Steel, structural	231.3	236.3	236.3
Tanks, steel	138.4	138.4	138.3
Valves & fittings	160.6	162.8	162.4
Wire mesh	160.8	161.9	161.9
Labor	175.1	178.8	178.6
Carpenters	160.7	163.6	163.6
Electricians	181.2	187.7	187.7
Painters	183.5	185.0	184.4
Equipment Index	173.6	175.7	175.2
Materials	173.4	173.9	173.8
Abrasives	160.3	160.0	160.4
Alloys, non-ferrous	117.2	121.9	123.9
Bars & plate, steel	223.5	227.2	227.2
Bearings	163.4	160.3	160.3
Belting	150.1	152.0	150.2
Bolts, nuts & screws	229.5	225.3	225.3
Chain	184.0	184.0	184.0
Controls (electrical)	181.5	180.7	180.8
Gear-reduction units	181.7	181.7	181.7
Hand tools, mechanics	192.9	195.8	195.0
Lubricants	122.8	123.0	123.0
Motors	147.3	147.9	148.0
Non-ferrous metals	120.9	128.1	128.1
Precision tools	153.2	153.2	153.2
Pumps	184.7	191.0	191.0
Tools, cutting	166.3	168.4	168.4
Valves & fittings	160.6	162.8	162.4
Labor	173.6	176.9	176.1
All mfg. labor	172.2	177.1	175.5
Machine tool labor	174.9	176.6	176.6
FACTORY'S COST INDEX	**169.7**	**172.1**	**171.7**

FACTORY . . . PRESS TIME REPORT • FEBRUARY 1959

Looking Ahead in Labor

You'll hear a lot about Taft-Hartley this year. It's coming up before Congress once again—and once more it will be examined, piece by piece.

This is the plan of the 86th Congress' Democratic strategist, Massachusetts Senator John F. Kennedy. His Senate Labor Subcommittee will hold T-H hearings. A special public committee of labor experts will also scrutinize its provisions and advise the Kennedy committee on what to do with it.

Such concentration is not new in the short history of T-H. The act has taken more of Congress' time and attention than any other labor matter. So it's important to find out what labor and management really want to do about it.

•

In all the T-H hullaballoo, Congress has changed it only once—in 1951, with a minor amendment. It's still a law that altered the old Wagner Act to make unions subject to prosecution for unfair labor practices (as employers had been), control compulsory unionism, outlaw the closed shop.

For the first few years of T-H. labor leaders tagged it the "Slave Labor Law" and demanded repeal. Management defended it all the way. These positions have altered somewhat. Most labor officials will take amendments. Many employers now also insist on rewriting certain provisions. Here are the key proposals on both sides:

On the labor side:

. . . *Let strikers in a new contract dispute vote in representation elections.* T-H now holds only their replacements can vote in a new union election.

. . . *Take out Section 14B.* It now permits the states to outlaw the union shop.

. . . *Eliminate the mandatory injunction.* It's used against secondary boycotts and jurisdictional strikes.

. . . *Give the federal government full control over labor in interstate commerce.* States now have police powers over violence in labor disputes, but little other authority.

On the management side:

. . . *Ban secondary boycotts and organizational picketing.* This would hit "hot cargo" contracts and "blackmail picketing."

. . . *Require a secret ballot among employees before a strike can be called.*

. . . *Give states more power to control labor disputes* —either in specific situations or by concurrent jurisdiction with the federal law.

. . . *Apply anti-trust laws to curb union monopoly.*

These are the areas where labor and management are almost unanimous. Yet T-H is so controversial—and complex—that union officials often disagree among themselves. Employers, too.

•

T-H has come up every year in Congress since 1947. Some years the discussion has been extensive. In 1953, for instance, the Senate and House Labor Committee held hearings. The testimony was later reprinted in 16 volumes, totaling over 7000 pages. Yet nothing happened.

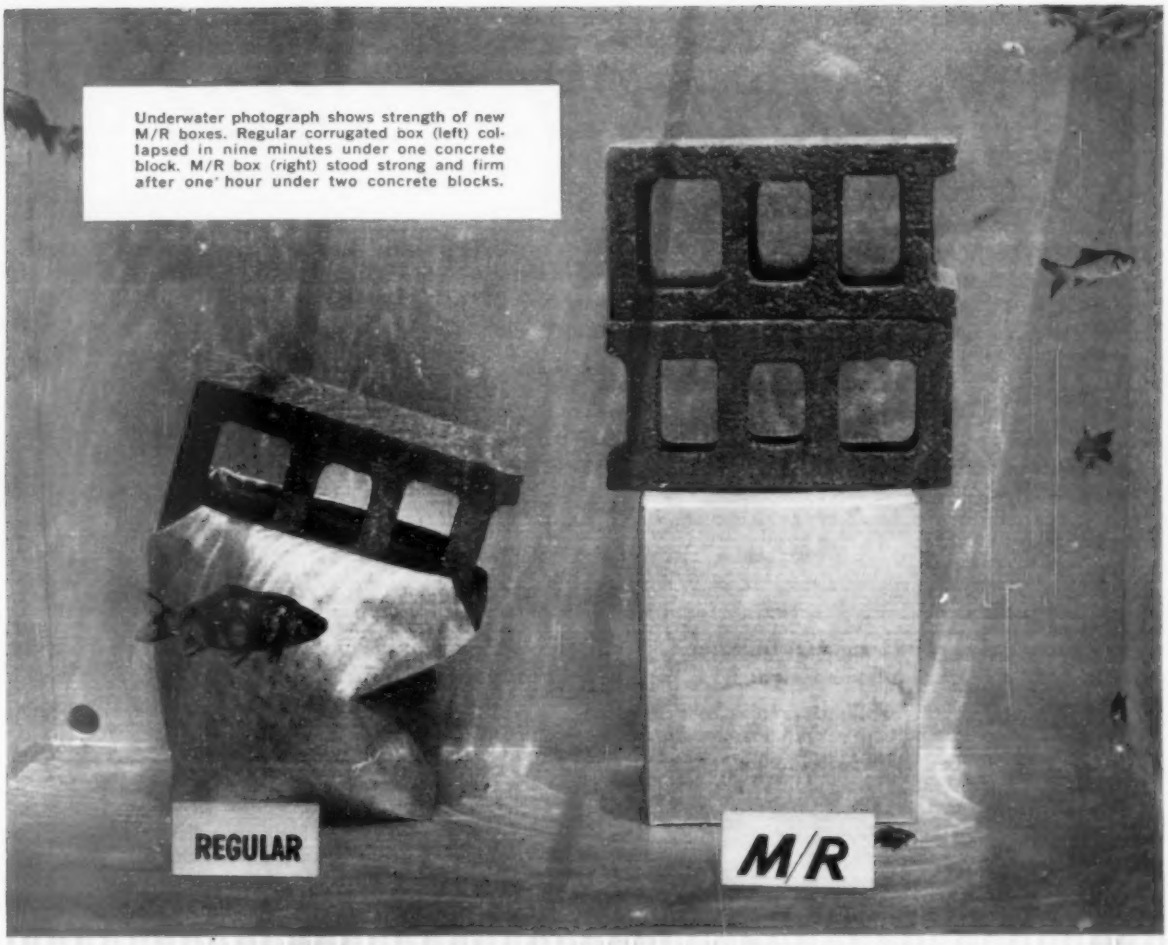
How has T-H survived this verbal onslaught? One reason: It has worked well. It is not the union-scuttler labor leaders predicted it would be. So there's no great urgency in Congress to tackle such a complex and troublesome subject. A vote either way would raise protests from the opposition view. This inhibits the Congressman's desire to vote for changes. He would get caught in the crossfire.

Political ramifications are extensive, too. Up to now, at least, Congress has been too evenly divided to go the way of management or labor—and it's too tough to go both ways at once.

•

There's a partial political shift in the new Congress with a greater line-up of liberals. This means the union view will be taken more seriously. But it doesn't necessarily mean a new labor-management law even now. It would still cause more of a storm to amend T-H than to let it lie.

SEE LABOR RELATIONS NEWS, PAGE 182


Underwater photograph shows strength of new M/R boxes. Regular corrugated box (left) collapsed in nine minutes under one concrete block. M/R box (right) stood strong and firm after one hour under two concrete blocks.
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New *M/R* Corrugated Boxes

stay strong when wet... even under water!

Important news about Hinde & Dauch's new M/R (moisture resistant) corrugated boxes: Hydrocooler tests show M/R boxes shed water; stay strong and durable for packing and shipping all kinds of wet products. Moreover, M/R boxes stack high and straight, save packing and handling time, provide remarkable product protection. Initial tests indicate shipping damage to peaches reduced 50%. The smooth, clean surfaces of new M/R boxes can be colorfully printed with your brand message. H&D Package Engineers are ready to design an M/R corrugated box for your product. Write, wire or phone for complete information today!

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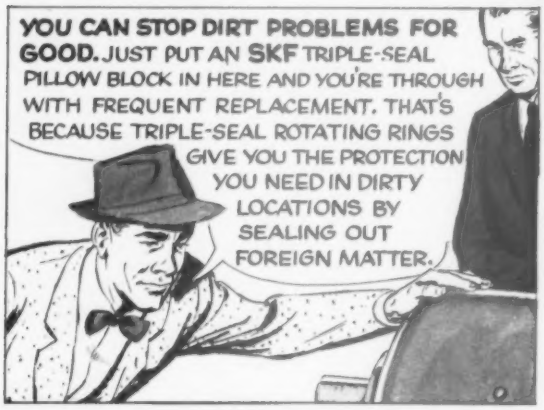
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LOOK, IT'S NEARLY IN ALREADY –AND IT'S EQUALLY EASY AND FAST TO INSPECT. BETTER CLEAN UP THE FLOOR NOW, TOO. LOOK AT THAT GREASE!
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FACTORY . . . OPINION

How Can We Get Better Cost Facts?

ASK ANY good plant management man what he needs most, and you'll usually get the same answer: Facts. Give him the facts, and he'll come up with the right decisions, he'll tell you. And if you probe further, you'll find that the facts most often needed are *cost* facts. More time is wasted and more ulcers are generated in getting good cost figures than in any other aspect of the managerial job.

So far so good. Let's now ask how good are we at getting these vital facts?

The answer isn't encouraging. In general, we are *not* doing a good job of providing the right cost data in the right form. And, as a result, operating management men are not able to fulfill their decision-making responsibilities at top efficiency. In fact, there are cases, readers tell us, where they are simply forced to guess about big and important cost elements.

How come? Let's listen to one reader who in the past couple of weeks unloaded this big complaint on two of us editors:

"My big gripe," he says, "is that the figures I get most of the time are lump-sum figures. They're fine for taking an over-all look at what's been happening. But they're no good for controlling or cutting costs. What I want is breakdowns—all kinds of breakdowns—of the lump sums. But can I get 'em? No!"

Whose fault is it? Let's listen to our unhappy friend again: "I blame higher management for the trouble, especially financial management. Accounting people simply won't give us what we want and must have. They tell us, 'Let's keep things simple; all those breakdowns cost money.' What they can't seem to understand is that the money the breakdowns would cost is peanuts compared to the money we lose by not having the breakdowns.

"For the sake of accounting simplicity, we throw away all kinds of opportunities to cut costs. The way I feel now, you might as well not keep any figures at all as keep the kind we do!"

A pretty strong indictment, isn't it? We're not prepared to start throwing rocks at all accounting departments, as our friend would. But we hear this complaint often enough to make us feel that there's real need for a better understanding between plant accounting policy makers and operating management personnel.

This is the same old problem of communication we all face so often. The words all sound clear, but the meanings don't get through. And then a certain amount of emotion slides into the picture and there's a battle instead of a solution.

Our suggestions for a solution:

First, stop sniping at those important lump-sum figures from accounting. True, they don't give you all the help you need, but they're useful. You can get your long-term trends. You can compute ratios of costs to personnel, to sales, to profits, etc. (For an example of how much you can do, take a look at pages 72 to 78 in this issue. Those maintenance cost figures and ratios have never been available before. They can be a good yardstick for judging your own costs.)

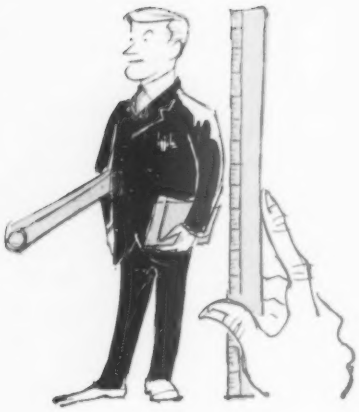
Second, make sure you really know what you want. Accountants have their gripes, too. And their biggest is that operating men have been known to ask for detailed information they don't need and can't use. To check this, we've just phoned a friend with a wide acquaintance among plant accounting people. Cleaned up, here's the gist of his comment: "What an understatement! Those rockheads can ask for more useless information than six computers could produce. Most of the time it's a blind search for alibis when somebody hauls 'em over the coals for bum costs."

There's the other side. So we repeat: Be *sure* you know what you want—and why.

Third, make a real effort to work with your accounting people and to enlist their help. We suspect that explaining specific cost problems and asking for help will often work wonders. And, oddly enough, the average operating man will find that he benefits from an improved knowledge of accounting practices.

So what's the answer to our original question, "How can we get better facts about our costs?" The answer is simply this: You *won't* get 'em by grunting and groaning and crying in your beer. You will get 'em by knowing exactly what you want (and why), and getting it through cooperative effort with accounting.

Accounting won't cooperate? Then remember this: Solving of just such problems as "won't cooperate" is the prime job of every man in management. So why not dry those tears and buy your controller a lunch, or give the factory cost man a cigar? Or something.



If you're playing along with the trend to measure managers on performance alone . . . or if you're tearing your hair trying to shape a really useful management appraisal program . . . or if you've got a plan you think is pretty good . . . you could be wrong, all three ways. But here's a plan that wraps up the whole matter. It's factual, mature, comprehensive, carefully researched. It will show you it's time for you to take . . .

5 Steps to a Plan That Will

"WE RATE our supervisors just on performance," says the works manager at Company X. "That's what they're hired for. We keep away from the intangibles. You can't measure them anyhow."

Unusual? Not a bit. This manager's view is right in line with the current trend in supervisory appraisal. But the trend is wrong—and so is he. In his plant, as in your plant, supervisors are being appraised at least five ways every day. Managers above and around them are forming definite opinions on intangibles such as personality, motivation, health, and stamina. The trend toward more objective performance appraisals makes sense. But the notion that intangibles aren't being measured is nonsense.

By CARL HEYEL
Management Engineer
Manhasset, N. Y.
(Based on his book, *Executive Appraisal*, published by American Management Association, New York.)

Needed: more system—What's needed is a systematic, objective way to do the whole job of appraisal. Adding system to your appraisal of tangible performance can produce results so solid that you can almost hang your hat on them. And adding system to the appraisal of personality, motivation, stamina, and health makes them much more objective factors than off-the-cuff judgments that are generated in the washroom or at the lunch table.

If you're a good manager, you're always carrying on informal appraisal. You continually size up your supervisors in terms of their departmental outputs, smoothness of operations, and the like. If you have good working relationships with them, you are always coaching and counseling. But experience shows that effective development calls for scheduled appraisal sessions. Frequency of once a year—perhaps at the anniversary of your man's entering your department—usually provides a sufficient period for changes to be discernible. A systematic appraisal procedure will provide you with a list of accountability factors and supplementary appraisal points against which to discuss results and areas for further improvement.

Hazards in subjective judgments—In companies where the management appraisal pendulum has swung entirely to performance measures, it's because they've found that a little knowledge in subjective values can be dangerous. So-called counseling by an executive on personal traits

Five key steps that will give you a foolproof way to measure managers

1. Measure performance

2. Appraise skills

3. Assess personality

4. Find motivation

5. Rate health

Really Measure Your Managers

can easily go beyond any original intent. It's not hard to wind up in the province of the professional social worker or even the psychiatrist. It can get far afield of the company's real interests.

It's well to keep this danger in mind and concentrate on the kind of results that are the department's business. For example, if the average standard-minute performance in a foreman's department is consistently high, if his scrap losses are low, and if his labor turnover and absenteeism are well within acceptable limits, you can take for granted that he's exercising effective initiative, leadership, and ability to get along with others.

Many companies conduct formal appraisal as part of their executive development programs. Professional staff departments spark much of the appraisal activity—provide aids and printed guides and forms, coordinate group opinions, and the like. But the line executive makes a big mistake if he falls into the habit of using such services as a crutch. It is his personal responsibility to set proper standards, judge how his subordinate executives are doing, and help them in their self-development. Formalized plans and printed forms are the least important elements of management appraisal.

What's needed is an over-all system that will evaluate all factors that should enter into appraisal of your supervisors. Here is just such a plan —in five steps:

1. Measure Your Man's Performance

The pitfall in appraising job performance is the assumption that it's simple. It's far from simple. There's a lot of thought behind each successful plan. You'll always find four main steps in every one. The manager and his supervisor need to (1) agree on his job description, (2) agree on accountability factors, (3) set specific performance goals. Then (4) you, as manager, must judge his performance, get agreement that your judgments are accurate.

REVIEW DESCRIPTIONS

Formal, written job descriptions for every position in your plant are essential for job performance appraisal. They are valuable starting

points for any discussions about supervisors' duties and responsibilities. They tell the limits within which the manager can make decisions and the kinds of decisions for which he must come to you. Such a description is basic to deciding what you'll measure, what is good performance, what the goals are.

Your company, like most today, probably has written job descriptions for every managerial position. But they're just as probably out of date. You should review each description with the supervisor concerned. And if your company doesn't have a system of formal descriptions, start to develop one right away.

It's effective to have a supervisor draw up the first draft of his position as he sees it. This forms the basis for a joint review, and both of you should agree on the final statement. Such statements should be informative but brief. They need not cover every conceivable duty. A description should at least tell who your man reports to and should give a summary of his position; his duties, responsibilities, and authority; his direct supervision over others, and the qualifications needed to do the job.

Job description statements should be specific. For example, "Maintains close contact with master mechanic on equipment performance" . . . "Is responsible for manning conveyor-belt filling lines in accordance with product sheets, and must obtain confirming authorization for necessary deviations." The entire emphasis should be on the job to be done, not on the individual.

AGREE ON THE MEASURE

These three steps are the basis of performance measurement:

Find the key results—Deciding what you'll measure depends on the position description agreed upon with the supervisor. Here's a list of key results that could be the result of agreement between a supervisor and his boss: (1) High direct labor productivity, (2) meeting departmental schedules, (3) good quality, (4) no shutdowns due to preventable equipment failures, (5) minimum idle time in switching from one machine line set-up to another, (6) reasonable flexibility in departmental schedules for rush requests or last-minute changes, (7) safety, (8) controllable departmental burden, and (9) labor relations.

Determine the measures—Once you've decided what the key job elements are, figure out a way to measure each element. The nine factors above are general. To bring them down to earth, apply specific measures such as these:

- Variations in standard minutes per hour produced. Variances in unit-cost standards. Analysis of idle time.
- Record of completion dates against schedule. Factory order backlog trend. Overtime record.
- Number of rejects. Complaints by sales. Friction with inspection.
- Days lost in shutdowns due to improper operation of equipment. Trend of maintenance and replacement costs per 1000 machine-hours.
- Cost reports on downtime.
- Complaints from production scheduling and sales.
- Departmental accident frequency and severity rates.
- Ratio of indirect labor to direct. Supplies consumed.
- Number of grievances. Absenteeism and labor turnover rates.

Decide what's par—Come to an early agreement on how important each attainment is in evaluating the supervisor's total performance. You may well agree that some of the key results, while important in themselves, have a relatively small bearing on a man's over-all job performance.

For example, in almost all plants, keeping to scheduled output is important. But it's conceivable that your type of product or production makes it easy to keep schedules. If so, your supervisors should be given little credit for meeting schedules. On the other hand, quality may be of the utmost importance and hard to control in your plant. The supervisor with a top quality record should get heavy credit.

A practical scheme is for you to agree on a rough percentage weighting of the accountability factors. To do this fairly, keep in mind the attention the supervisor must give to the factor to do a good job. Consider the dollar loss if the results are unsatisfactory. Consider the loss of customer good-will, the effect on other departments, and the like. For example, keeping unit costs down may be rated at 40%, labor relations at 25%, quality at 15%, and safety at less than 10%.

Cut out factors that rate under 10% or combine them with other factors. This is admittedly not a precise mathematical procedure, but it will keep the various factors in reasonable relation to one another.

Now you're ready to discuss what's par for the courses. Discussion of the entire operation will usually bring ready agreement on what makes a reasonable measure. For example, no shutdowns due to improper operation of equipment may be desirable but may not be possible. Considering physical conditions or green help, your supervisor might well argue for a reasonable leeway. You could agree to allow a limit within which his operation would still be considered satisfactory.

ESTABLISH GOALS

The most fruitful part of job appraisal is the joint development (between manager and supervisor) of special goals for the coming period. These goals are quite apart from the expected smooth running of the day-to-day job. Ask the supervisor to draw up targets for himself. In this way, you're laying the groundwork for his own self-appraisal.

Goals for end-of-period review should be in two broad categories: (1) special targets related to the job and (2) specific plans for self-improvement.

For example, your supervisor might want to find a way to make tests during process, rather than on the finished product, and thus cut loss on rejects. This would be a job-related special goal. To speed and insure his personal development, you and he might decide what training or contacts he should undertake. He can decide what his long-range educational program should be and what in-plant experience he should try to acquire.

JUDGE PERFORMANCE

Appraising and counseling on the basis of tangible results will put the major emphasis where it belongs—on operating results. And this will also stimulate planning ahead for improved operations. At the end of the year you can sit down with your supervisors and review what was done. There should be little room for argument. Either your men reach their goals or they don't.

2. Appraise Your Man's Skill

How do you rate your man's planning, organizing, and delegating skills? Here are seven suggested steps to guide you:

WEIGH KNOWLEDGE, SKILL

Technical knowledge and experience are not usually considered part of managerial skills. But getting them into perspective is the best first step. Except under special circumstances, you wouldn't put a man in charge of a department without some background in its technical work. Appraisal considers technical competence in the light of specific job requirements.

How close to the "firing line" must he be? The farther down the line an executive is, the more he is usually concerned with day-to-day or even hour-to-hour operations. He is less concerned with broad company policies (except for interpreting and applying them to his people) than higher echelons.

As a rule, unless he can display familiarity with the work, he will not have the respect of the people on the line. In addition, many first-line supervisory or assistant department-head positions are actually of the group-leader type, where the manager is expected to do certain operating jobs himself. In such a case, no amount of general background in managerial skills will fill the bill if he hasn't the knowledge and experience to run the operating part of his job.

How much backstopping is economically possible? The more backstopping a department can afford, the less you need to be concerned about the degree of technical background of an individual department head. It may well be that in judging between two men to fill a subordinate executive position, you'll have to choose a man with lower managerial skills but with seasoned experience in many phases of the work, because your budget simply won't permit further specialized supervisory or "assistant-to" positions.

EXAMINE LONG-TERM PLANS

Planning must be part of every job. But the need for long-range planning decreases as you go down the scale of responsibility. Since we're concerned with supervisory rather than executive appraisal, judgments about planning ability must largely rest on results obtained from the technique of performance goals and reviews. Here are some guidance questions that are applicable to supervisors.

- Are there reasonable time allotments in plans that he advances for consideration?
- Does he provide for changing conditions, with "pullback" points?
- Does he set up intermediate goals and checkpoints?
- Does he do organizational blueprinting when he is blocking out projects?

ANALYZE CURRENT PLANS

Not all supervisory positions require long-range planning but all do require planning for current operations. Here's a brief checklist of questions to raise:

- How detailed is his knowledge of the skills and weaknesses of his men on the line? Do spot checks and discussions of specific incidents bear out these judgments? Has there been any evidence of favoritism in his appraisals?
- Are there frequent crises arising in his department?
- Is the overtime record of his department out of line?
- Are there bottleneck complaints about his department? What does a spot check of his backlog show?
- Are there performance control points by which he can take departmental readings at intervals?
- Does he have enough people trained to sustain normal functioning when there are unexpected absences?
- Does he take unusual problems out of the flow of regular work for his own immediate attention?
- How good an understudy has he?

MEASURE DIRECTING SKILL

"Plan-do-check" is a long-established formula of scientific management. In this evaluation, concern yourself with the "do" part.

The ability to direct work effectively begins to be taxed as soon as more than one person reports to a supervisor. At that point it is essential that direction be accompanied by coordination. Good coordination exists when the activities of individuals and groups under a supervisor mesh smoothly, and objectives are reached with minimum upset, delay, and confusion.

The question to ask about a supervisor is, "Are poor results due to planning and organizing the work, or are they due to faulty coordination and direction?" Here are some points that will help you to make this distinction:

- Were any critical incidents traceable to misunderstanding on the part of someone he had directed?
- Have there been instances of communications outside the department being made by word of mouth, without confirmation in writing?
- Is he concerned about the tone of his remarks as well as their content? Points to consider in reviewing his pattern of communications concern abruptness, curtness, bumptiousness, discourtesy, and the like.
- Is he a good listener? Or does he interrupt often?
- Is he careful to have standard instructional methods and procedures in writing kept up-to-date?
- Are his memoranda concise, complete, grammatical?
- What is his "frictional record" in his dealings with people under him? Are there repeated flare-ups? If so, is there a pattern of such explosions?
- Is he receptive to suggestions from those he directs?
- Does he apply the recognized human-relations considerations about such things as criticism, recognition of work well done, and fairness in allocating work loads?
- Does he "oversupervise"?
- Is his supervision on the right note of personal-impersonal?
- How does he "pour on the pressure"? Does his manner induce calmness—or tension?
- Is his group performance spotty? Are some units or individuals under his supervision turning out better results than others?
- How is his group's teamwork? Does it rise to an emergency?

EVALUATE DELEGATION

Inability to delegate may be dangerously hidden. Judged on performance alone, a department head may be doing well—schedules met, costs in line, quality above reproach. Yet he may be carrying everything under his hat and if he's absent suddenly,

his administrative weakness becomes painfully evident. Here are things to watch:

- Are there delays and inadequacies in his longer-term planning? Is he always putting out fires?
- What is his personal overtime record? Is he doing something somebody under him should do?
- Is he hard to get to because he's tied up with subordinates?

CHECK ON FOLLOW-UP

The "check" part of the "plan-do-check" formula is fully as important as the other two parts. But most of the factors that bear on this evaluation point will have been covered in other appraisal steps. Follow-up more properly concerns an attitude than a skill. Following are some additional questions that may be pertinent at this point:

- Is your man operating a danger-signal control system? He was supposed to set up control points. How are these being flagged?
- Is he applying the "management by exception" principle? That is, is he concentrating on deviations from standards?
- How quality-conscious is he? Does he put volume ahead of quality?
- Is he in danger of becoming too "chairborne"?

MEASURE TRAINING SKILL

This is an important management skill that may not show up in tangible measures of output. Helping to develop people takes time and money. Questions to raise:

- Have discussions indicated that he recognizes his responsibility as a trainer? Has he provided for trainees in his organization plans?
- What is his record on men who "graduated" from his department?
- What use is he making of training aids and facilities?
- Does he push for promotion of good men out of his department, even at inconvenience to himself?

3. Assess His Personality Traits

Personal traits inevitably get into any appraisal discussion. Why? Because they're at the root of a man's poor performance results on his present job. Or they're significant factors in judging his qualification for a proposed job.

The main purpose here is to help avoid confusions and misunderstandings by clarifying terms.

Of course, if your company's personnel department has results of tests given the supervisor when he was employed, or from time to time thereafter, get all of the basic information for your file on him. But look upon these as background information. If you have lived with the man for an appreciable period, you have seen him react under plant, not test conditions.

Our personality checklist in this section (panel, p. 67) is hardly all-inclusive. (It has been estimated there are some 18,000 different terms that can be used to describe a person.) But combination of the terms listed is found on many appraisal forms, and they cover elements that have significant bearing on a supervisor's effectiveness. But it's easy to let one outstanding trait overshadow all others. Psychologists call this fallacy in appraisal the "halo effect."

Before reading the checklist, look over these definitions of some general terms that are often used rather loosely:

A trait is a distinguishing quality of a person—a distinctive, definable characteristic. It may be one predominant aptitude, or a combination of a number of aptitudes or behavior characteristics.

A behavior characteristic is a pattern that an individual sets by habitual repetition.

Personality is the sum of the traits and behavior characteristics that a person presents to the world and that determine the reactions of others to him. There's no clear dividing line between such terms as personality and temperament. Temperament is the characteristic of an individual as revealed in certain feelings, moods, and desires. We usually describe a person's temperament as cheerful or irritable. In common usage, when we say a person is temperamental we mean he swings unpredictably and violently from one set of feelings, moods, and desires to another. If we say he has a cheerful disposition we mean that this characteristic is fairly stable and predictable.

Ability is the power to perform, as distinguished from *aptitude,* which represents a latent capacity to perform after the necessary skills have been acquired. Although unsuspected aptitudes may be revealed, a person does not grow in aptitudes after about age 16. He will only develop more ability in certain activities up to the limit of his intelligence and of the aptitudes he has. Of course, his willingness to work and develop himself is also a factor.

Skill is a highly developed ability that expresses itself in superior performance.

4. Find Out His Motivation

On broad grounds, perhaps there's only one question that need be asked about a man in this area: Is his basic motivation service, or is it predominantly selfish?

Since business obviously can't be run by pure idealists, and the practical make-up of the successful supervisor and plant executive will put his motivation somewhere in between. In our competitive economy, we must continue to rely on self-interest and a desire to excel in contests as powerful and legitimate motivators. The following suggested appraisal questions are therefore in order:

- Is he ambitious? Is his ambition realistic? Is it commensurate with the abilities and aptitudes he has demonstrated?
- Is he over-ambitious? Does his eagerness to get ahead cause him to want to make a mark for himself by taking risks, or by taking undue personal credit when he doesn't deserve it and soft-pedaling the contributions of others?
- Does he show a healthy competitive drive—an eagerness to win out over unlucky circumstances, and a willingness to expend continued effort to be top man in his activity? Is he stimulated to work hard by obstacles and opposition?
- Has he become so single-minded as to make him one-sided—a man without outside interests and no "small talk"?

To evaluate managers, here's a PERSONALITY CHECKLIST

Accuracy—If the pattern of your man's behavior shows inaccuracies and poor work, are these due to carelessness, lack of knowledge, or poor judgment? If the first two, training and vigilance will help. The last may call for questioning.

Adaptability—Does he admit mistakes? Is he oversensitive to criticism? Does he cooperate in new systems and procedures? Can you ascribe failings to age?

Analytical ability—Can he state problems clearly? In broad terms and in terms of immediate application? Does he realize what's pertinent and what's marginal? Does personal bias affect his conclusions?

Decisiveness—Be careful here. This trait gets involved in undesirable counter-traits. For instance, he may look decisive—but be making snap decisions.

Initiative—Does he find his way around bottlenecks? In doing so does he regard the feelings of others and the effect on related operations?

Intelligence—What do test results show? If his score is below those reached by the top 0.3 of the men in the same educational classification, you'll be gambling on him. Is the present or future job one in which he'll be substantially on his own?

Maturity—This isn't a matter of age. Some people may mature in their early 20's. Others can remain immature all their lives.

Mental alertness—How quickly can he put two and two together? Is he alive to the implications of his work—and what's going on elsewhere?

Habits—You can't size up a man completely without some final catch-all questions about habits that may bear on his work. Make a quick run-down of all his other traits. Does he have any outstanding trait not mentioned—or any unusual combinations? If he has some undesirable habits, has he overcome such habits in the past?

5. Rate His Health and Stamina

Without good health and stamina, high ratings in all other qualifications may be largely canceled out. In younger supervisors this factor is usually taken for granted. But for promotion to more responsible positions, you may be dealing with the near-40 and over-40 range. It's in this category that health presents a potential hazard.

Here are certain commonsense layman's questions you can raise:

- What do the company's medical reports show? If your man has been asked to take certain precautions, can you be sure he is doing so?
- Is he temperamentally able to delegate? Have vacation-skipping and late working become a habit?
- What is his attendance record?
- Is the position to which he is being considered for promotion so important that a special medical check-up is advisable?
- If he is an older supervisor or department head, would it be worthwhile to make realignments in duties to ease a physical strain? If so, should this be flagged as a temporary expedient, or should there be a formal realignment in the position description?

Summing Up Your Evaluation

Take all five factors. Analyze them separately and in depth. They furnish information for further development of men. They offer guides to promotion. But for comparisons between men, for measurement of progress, and as a basis for a company-wide rating plan, you will want a uniform means of over-all scoring on the major appraisal areas.

With formal company plans, special forms are usually distributed for comments on specific factors, summary statements, scoring checks. The specific form is unimportant. Once the principles are understood, you can easily devise the form.

Follow-through—The payoff in the whole appraisal activity is in getting the results across to the supervisor and in getting him to take the next steps for self-improvement. The planned appraisal interview provides a special occasion for taking a look with the man at his job and his performance. Your discussion should be informal. But this need not imply that the meeting is not carefully planned.

Concentrating on performance results—against standards and goals that the supervisor himself helped set up—removes much of the awkwardness that managers feel in conducting a counseling meeting. Prime emphasis on the "How am I doing?" aspect does a lot to get away from discussion of personalities.

Rules for interviews—These ground rules will give you some practical guidance in the interview:

- Schedule enough time.
- Focus on the future.
- Call a recess in the superior-subordinate relationship.
- Avoid personalities.
- Don't over-emphasize scoring.
- Keep your summary statement absolutely confidential.
- Give the man a chance to talk.
- Give him a chance to save face.
- Don't bring in comparisons with others. Focus attention on performance to standards set on his job.
- Don't make promises lightly.
- Determine ways you can help.
- Playback and close. Review your agreements. End the interview on a positive and helpful note.

FREE FILE COPY of this article available while supply lasts. Circle FC-25 on Reader Service Card next to back cover. For complete FC list, see page 178.

43 Ways to Use Your Drillpress

And with these as a starter you'll think up another 43 of your own. It's the most flexible tool in your shop—and your best way to do those odd jobs.

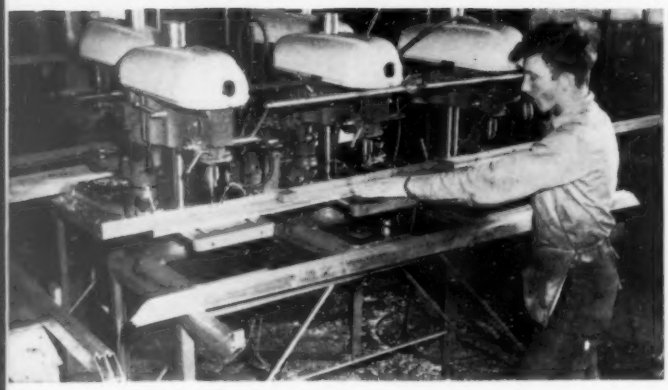
IN A SMART PLANT a drillpress is far more than a tool for drilling holes and tapping. It's about the best odd-job performer in the shop. And probably the most adaptable to various set-ups.

Why bother about odd jobs? Because they're the jobs that your maintenance workers wrestle with every day. And they're the offbeat operations that crop up in manufacturing familiar products as well as new ones. In maintenance these odd jobs often cost much more than just maintenance labor. In production they can eat up profits.

Why bother about different set-ups? Because they can develop into better methods, which are your prime source of cost improvements.

To see how versatile this common tool is, look at the ideas that follow in text and photos. They come from Delta Power Tool Division, Rockwell Manufacturing Company (Pittsburgh). You're sure to find some of them useful in your plant. And they'll give you a start in figuring new ways of your own to use your drill presses.

JOB	SET-UP	ADVANTAGES
1. **Slot ends of pins.**	Mount small hand grinder with cutting blade or disk on drillpress table, hold pins in drillpress chuck (no motor required), feed against cutting tool.	Easy set-up for hard-to-position work.
2. **Thread outside diameters.**	Use self-opening or pneumatically controlled die chuck to thread, mount drillpress horizontally for convenient loading.	High production—up to 800 per hour.
3. **Drill hard-to-position, irregularly shaped parts or castings.**	Mount drillpress upside down below work table and position part on the machined surface to be drilled.	Simplifies set-up.
4. **Drill holes in both sides of a yoke simultaneously.**	Mount two drillpresses on same column, one upside down below work table. Position yoke and operate drillpresses simultaneously by mechanical linkage or pneumatic controls and feed.	Combines operations, eliminates in-between handling.
5. **Deburr small castings.**	Hold rotary deburring file in chuck, hold casting against it.	Most convenient method for deburring easy-to-handle castings.
6. **Mill slots in sides or ends.**	Mount milling cutter in chuck, push work past in sliding jig.	Low-cost tool for precision operation in the shop.
7. **Provide even brazing temperature in joining round parts.**	Rotate parts in opposing drillpresses mounted on one column, one upside down. Join the motor shafts to assure equal speed. Position flame on joint.	Assures high-quality joint in inexpensive set-up.
8. **Drill two or more workpiece faces at the same time.**	Mount drillpresses at any angle around holding fixture. Feed mechanically for simultaneous operations.	Reduces cost as many times as number of operations combined.
9. **Drill one hole in several small parts at the same time.**	Mount parts in circular work fixture, use multiple-spindle attachment.	Drills 2 to 10 pieces in time required for one.
10. **Drill and countersink at the same time.**	Mount two drillheads on one column with one inverted below the work table. Use drill in top spindle and countersink in bottom. Use holding fixture and set drill stops so opposing drill and countersink come close but don't touch. Operate spindles simultaneously by mechanical linkage or pneumatic devices.	Combines operations, assures greater precision than combination drill-and-countersink bit.
11. **Drill small-lot multiple holes.**	Make Plexiglas model to check tooling and instruct operators. Drill on multiple-spindle drillpress made from standard table sections with as many spindles as average number of operations per part.	Plexiglas model prevents errors where many operations are performed on many different parts. Many-spindled drillpress is most easily set up, minimizes handling.



12. **JOB: Drill widely spaced holes in a line.**

SET-UP: Position spindles according to hole distances, operate simultaneously by connecting operating levers or quill pinions.

ADVANTAGES: Combines operations, eliminates in-between handling of workpieces.

13. **JOB: Drill multiple holes with conveyorized work moving from spindle to spindle.**

SET-UP: Conveyorize operator. Let operator ride on caster-mounted cushion resting on angle-iron tracks on bench in front of multiple-spindle drillpress.

ADVANTAGES: Reduces worker fatigue, minimizes lost time.

14. **JOB: Mill parallel grooves.**

SET-UP: Mount two drillpresses face to face with end mills. Push work on sliding jig.

ADVANTAGES: Difficult precision job performed on inexpensive set-up.

15. **JOB: Put a polish on almost any common object with steel wool.**

SET-UP: Wrap steel wool around mandrel held in chuck.

ADVANTAGES: Is easily set up, allows other uses of tool as well with minimum change.

16. **JOB: Drill assembly holes in components being assembled on conveyor tables.**

SET-UP: Wheel caster-mounted drillpress (horizontally and vertically mounted) alongside conveyor table. For more stability, put brackets between assembly and drillpress.

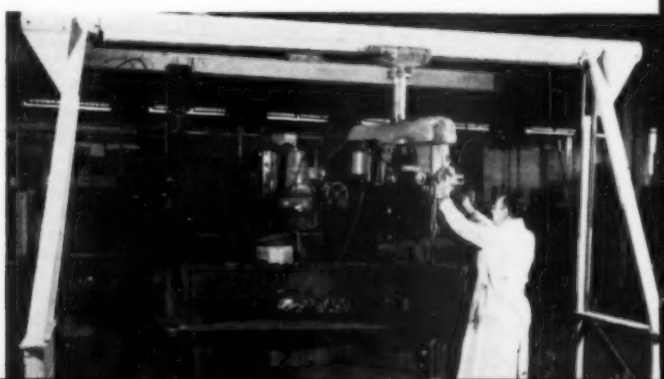
ADVANTAGE: Work not moved to machine shop.

17. **JOB: Drill large pieces—panels, assemblies, and other such workpieces.**

SET-UP: Use standard overhead drillpress, but mount the drillpress on track so it moves, not the workpiece.

ADVANTAGE: No work movement for all drilling.

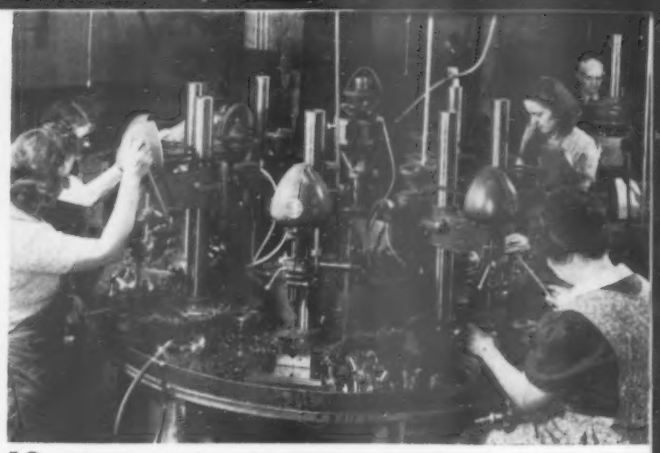
Turn the page



18. JOB: Combine drilling and other machine work.

SET-UP: Move drillpresses in place so milling-machine operator (for example) can operate one or more while milling machine is in automatic cycle.

ADVANTAGES: Makes full use of operator time. Management not penalized by automatic operation.



19. JOB: Perform successive drilling operations.

SET-UP: Station a drillpress for each operation on a round table and an operator at each drillpress so that work can be passed from one to the next.

ADVANTAGES: Facilitates work flow, minimizes lost time in handling, reduces operator fatigue.

20. JOB: Perform successive drilling operations.

SET-UP: Station drillpresses, equipped with pneumatic feed devices, around rotary table with fixtures that index under each head. Use one or two stations for loading, unloading.

ADVANTAGES: Combines operations, eliminates in-between handling of workpieces.

21. JOB: Cut large holes in materials or work pieces made of metal or plastic.

SET-UP: Use flycutters.

ADVANTAGES: Inexpensive method for job often requiring special equipment.

JOB		SET-UP	ADVANTAGES
22.	**Drill multitude of parts on one multiple-spindle drillpress.**	Use fixture plate that holds all fixtures for a part and is bolted to drillpress table for use.	Reduces set-up time to practically nothing. Permits more frequent scheduling of short runs.
23.	**Turn bar stock.**	Using quick-change chuck, hold stock in chuck and feed against fixture-held cutting tool.	Unskilled operator does job on inexpensive set-up at higher rate than is usual on lathe or screw machine.
24.	**Remove metal in dynamic balancing of pulleys, etc.**	Mount drillpress with spindle over pulley.	Weight removed at required points without removing pulley from machine.
25.	**Drill pieces too large for throat capacity of the drillpress.**	Mount drillpress upside down below large work table. Use foot feed attachment to free operator's hands for positioning work.	Large parts may be drilled, spot faced, etc.

JOB		SET-UP	ADVANTAGES
26.	**Drill large panels.**	Mount drillpress column on pivoting wall bracket.	Gives drillpress long reach.
27.	**Drill plates or assemblies too large to position under radial drill or to the machine.**	Mount one or more drillpresses on a carriage that will ride astraddle the assembly.	Permits easy, accurate drilling of pieces of any size.
28.	**Drill "drill-at-assembly" holes.**	Mount drillpress on casters, move drillpresses to assembly points, use 115-volt a-c drillpress motors for convenience in connecting.	Provides accurately drilled holes without moving assembly work into machine shop.
29.	**Combine drilling operation with manual task.**	Use mechanical feed. Let operator actuate drillpress, perform manual task while drillpress drills.	Two operations performed for the cost of one.
30.	**Drill and load at the same time.**	Use sliding jig with two fixtures so that one may be loaded while other is under spindle.	Provides continuous tool operation except during indexing.
31.	**Drill and load at the same time.**	Use two drillpresses (for identical or successive operations) with mechanical feed. Let operator unload and load one while other operates.	One drillpress stays in continuous operation.
32.	**Drill, load, and unload simultaneously.**	Use rotary indexing table with work fixtures, pneumatic feed.	Operation continuous except for indexing time.
33.	**Perform successive drilling operations at one drillpress.**	Let rotary table fixtures hold part for various operations, index from station to station as operator shifts part from fixture to fixture and changes tooling in quick-change chuck.	Permits successive operations at one station by one operator. Minimizes handling-tool investment and floor space required.
34.	**Perform successive drilling operations.**	Position floor-model drillpresses around curved or semicircular table.	Minimizes movement between spindles, is easily set up by changing number of drillpresses.
35.	**Perform successive drilling operations.**	Use turret drill attachment.	No stopping drillpress; little or no work movement.
36.	**Perform direct tapping.**	Equip drillpress with reversing motor and microswitches to control it.	Has greater capacity than torque-controlled tapping attachment, costs only a fraction as much as standard tapping machine.
37.	**Countersink nut blanks on both sides.**	Mount two drillpresses horizontally with nuts fed between them. Use mechanical spindle feed devices and position nuts with vibrating hopper plus friction wheel driven from drillpress motor.	Production rates of 4800 per hour have been attained.
38.	**Mix paints and other substances.**	Use mixing propeller in drillpress chuck.	Simple tool for occasional jobs.
39.	**Add operation to multiple-spindle set-up.**	Move additional floor-model drillpress to end of multiple-spindle table.	Permits extra step without changing tooling or rescheduling for second run.
40.	**Cut square holes in wood.**	Use standard mortising attachment.	Inexpensive method for job often requiring hand-tool work or special equipment.
41.	**Mill casting faces.**	Mount milling cutter in drillpress, protect operator from chips by using pipe shield around cutter.	Time-consuming job done in seconds on low-cost machine.
42.	**Rout metal precisely.**	Hold work in compound slide rest, designed for lathe operations. With end mill in chuck, feed work by compound motion of the slide.	Complex work done with no special tooling and without tying up heavy machines.
43.	**Drill large and small hole simultaneously.**	Mount smaller drillpress on table of larger or on table of drilling machine.	Combines operations requiring different speeds and feeds, eliminates in-between handling.

FREE FILE COPY of this article available while supply lasts. Circle FC-26 on Reader Service Card next to back cover. For complete FC list, see page 178.

Now, for the first time, you can see...

How Industry's Maintenance Spending Is Related

THE BIG PICTURE:

For maintenance and repair, the manufacturing industries today are spending...

NOW, THE DETAILS:

The 687 companies in FACTORY's report are spending, for maintenance and repair, the equivalent of these percentages...

4 1/8 % of their net sales

5 1/2 % of the cost of goods they sold

6 1/2 % of their gross property

What Industry Is Spending Today

To help you size up your own maintenance program, FACTORY probed deep into costs in 687 manufacturing companies. Here, for your use, are the findings.

FOURTEEN-BILLION dollars almost on the nose! That was industry's annual maintenance bill for 1957. And there's every reason to believe it didn't change much up or down in 1958.

How does FACTORY arrive at this $14-billion? From an intensive study of statistics in the files of the Securities & Exchange Commission. Raw data were tabulated under direction of Douglas Greenwald, chief statistician of the McGraw-Hill Department of Economics. They include maintenance and repair costs, net sales, cost of goods sold, net profits after taxes, and gross and net property.

All data are for annual periods. They were derived from reports filed before September 1, 1958. A few data are for the fiscal rather than calendar year. Because we wanted to analyze reports closest to calendar 1957, a few of them extend back into small parts of 1956 or forward into small parts of 1958.

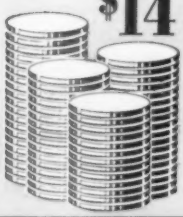
The 687 companies in FACTORY's study reported a grand total of $182.2-billion in net sales. Based on a grand total of $340.6-billion for net sales of all manufacturing in 1957 (U. S. Department of Commerce figures), our study therefore reflects the experience of 53.8% of all manufacturing companies, incorporated and unincorporated. This 53.8% group, the study shows, spent $7.51-billion for maintenance and repair in 1957. Extending this to all manufacturing yields a figure of $13.97-billion—practically $14-billion—spent for maintenance and repair in 1957.

WHAT THE BIG PICTURE SHOWS

The major findings of this study appear in the summary tabulation on the foldout pages (75-78). The study reveals many significant facts, hitherto unknown and subject only to guesstimates. Here are the facts about the annual (1957) cost of maintenance and repair of property, plant, and equipment in 687 companies. These costs show a wide range. And this is the way they run:

• 0.04% to 17½% of the sales dollar—average is 4.12%; median, 2.45%.

to Other Key Figures



$14 BILLION

Projected from reports of corporations representing 53.5% of all net sales in manufacturing.

%

12 1/10 of their net property

%

67 1/3 of their net profits

for Maintenance

- 0.04% to 33% of cost of goods sold—average is 5.50%; median, 3.18%.
- 0.5% to 42% of gross property value—average is 6.52%; median, 5.89%.
- 1% to 172% of net property value—average is 12.07%; median, 11.05%.
- 2.5% of net profits minimum (maximum is not computable because of some net losses)—average is 67.29%; median, 61.54%.

Statistics on the last two items (net property and net profits) are not given in the summary tabulation. But they are available along with other valuable data (see end of this article). The net profits tabulation was omitted because we found it unstable.

NOW FOR THE DETAILS

Thus far you have seen only the highlights of FACTORY's study. Of even greater significance and value to individual companies are the three major breakdowns that follow the grand total figures (see the pullout pages):

- FACTORY's 5 manufacturing groups.
- 21 major SIC manufacturing groups.
- 85 selected SIC industry groups.

For those unfamiliar with the five FACTORY groups, there's an explanation on page 214. In general, their names are key descriptions of their industry content. The names of each of the 21 and 85 subdivisions of the two SIC groups also are related to their manufacturing activities. (See footnote 3, pullout pages.)

HOW TO USE THIS STUDY

Here are the key values of FACTORY's study:

- It gives reliable, detailed dollar figures on the cost of maintenance in all manufacturing.
- As such, you can use it to check on the status of operations, find out where you stand.
- If your company's position is on the high side of dollar costs, the study will spur you to audit your operations and make sure you are getting the most for your maintenance dollar.
- If your company is on the low side, don't be complacent. You may be skimping on maintenance, paying penalties in big downtime, lower output, physical deterioration, and higher manufacturing costs.
- Even if you're in the middle there's no reason for satisfaction. You may still be one of those reported in FACTORY's survey of maintenance management practices (September, 1958) who are not wringing economies through better cost records, work planning and scheduling, training, stores management, preventive maintenance, work measurement, and other modern management techniques. Remember, this study shows what maintenance *does* cost in industry, not what it *should* cost in your plant. It's an indicator of your status in your industry, not a measure of performance.

Perhaps the following tips will suggest how you can use these statistics:

Improving maintenance cost records—Unless your company records produce summary statistics comparable to FACTORY's tabulation, you cannot find where you stand in your own industry. If you don't know where you are, this roadmap does you no good. So higher plant management or the maintenance manager now has a strong reason and argument for setting up or improving the cost records needed to compute reliable maintenance cost figures.

Obtaining better recognition of maintenance—There are still many plants where the importance of the maintenance function is little recognized. A good way to jolt higher management into recognition is to mark off the cost statistics from FACTORY's tabulation for your specific industry, send the report to the "money" boss. Then let him find out the company never segregates maintenance costs—thinks they're not that important.

Another key toward better recognition, if you have good cost records, is to show higher management the contrast between net profits and total maintenance cost. For your company may be like one of the 175-odd companies in the upper 25% whose maintenance costs are higher than net profits.

A third way to gain recognition: Develop a figure to show how many dollars of your net sales are required to pay for each $1000 of maintenance cost. FACTORY's study says $24,000 is the average.

Demonstrating the high cost of maintenance—Say your company rates up near the top spenders. And assume the maintenance manager knows he can cut costs with known techniques. But higher management has

Story Behind the Story

Those are three FACTORY editors—Wyder (left), Boyce, and Stanbury—in the photo above. They're plowing through just a small part of ⅒-acre of folded 11x14-in. sheets spewed out by the high-speed printer of a Univac electronic computer. The printout is the backbone of this article, "What Industry Is Spending Today for Maintenance and Repair."

Starting point of this searching FACTORY study: the New York and American Stock Exchanges, where some 2500 corporations, in compliance with Securities & Exchange Commission rules, file financial reports. Seven man-weeks of FACTORY's work there revealed 687 corporations that had filed data suitable for this study. FACTORY had these data put on punched cards.

Next step: Bring in the key ingredient—cooperation of the skilled personnel of the automatic programing department, Remington Rand Univac Division, Sperry Rand Corporation. The programers set the problem up, fed the data to Univac.

Univac computed seven ratios for each of the 687 corporations, memorized 4809 ratios. It also ranked each ratio by size within each of 124 subgroups and sub-subgroups (and within the entire 687 corporations), then pinpointed average, minimum, decile, quartile, median, and maximum values of such groups. Without Univac this job would have required 3472 sorting passes in a mechanical sorter, plus manual ranking and reading of cards, plus transcribing 19,250 percentage figures—untold days of work. Univac took 3½ hours of machine time for this.

But 3½ hours is only a small part of the work the programers and Univac did. It took nearly six man-weeks to set up the 2000-odd instructions—would have taken much longer without the new, simplified Flow-Matic programing method. A preliminary printout of tape instructions plus raw data filled almost 1000 feet of 14-in. wide paper. Five intermediate print-outs (over 2000 feet) had to be produced before final data were generated.

Final output data filled over 66 feet of single-spaced 11x14-in. paper. From these sheets, FACTORY editors selected what you see on the pullout pages (opposite)—the most significant facts ever revealed about the cost of maintenance in American industry.

refused money for such programs because it has no proof of results. FACTORY's tabulation offers cost data to prove that other companies are doing better and that your promises of lower maintenance costs are attainable.

Proving the need for better maintenance—Assume your company is at the low end of the spending range. And assume the maintenance manager hasn't been able to win any budget increases to preserve plant and equipment. FACTORY's tabulation gives proof that your company may be skating on thin ice.

Justifying your present costs—Let's assume your annual plant maintenance bill lands you somewhere above the average or mid-point in maintenance expenditures. And higher management takes it as a sign you should cut down. What are you going to do?

In the first place, is this standing bad? Not necessarily. In every statistical study like this, half the companies must be above mid-point. The important thing is, do you belong there? The smart maintenance manager won't dodge the facts. He'll collect data to show the money is being well spent. He'll check how much is actual maintenance expense, how much is capital expansion or improvements. And he can draw on many reasons why plants in identical industries don't have the same costs. To name a few variables: age and condition of facilities and equipment, climate, single- or multi-shift operation, quality standards in maintenance, and equipment replacement policies.

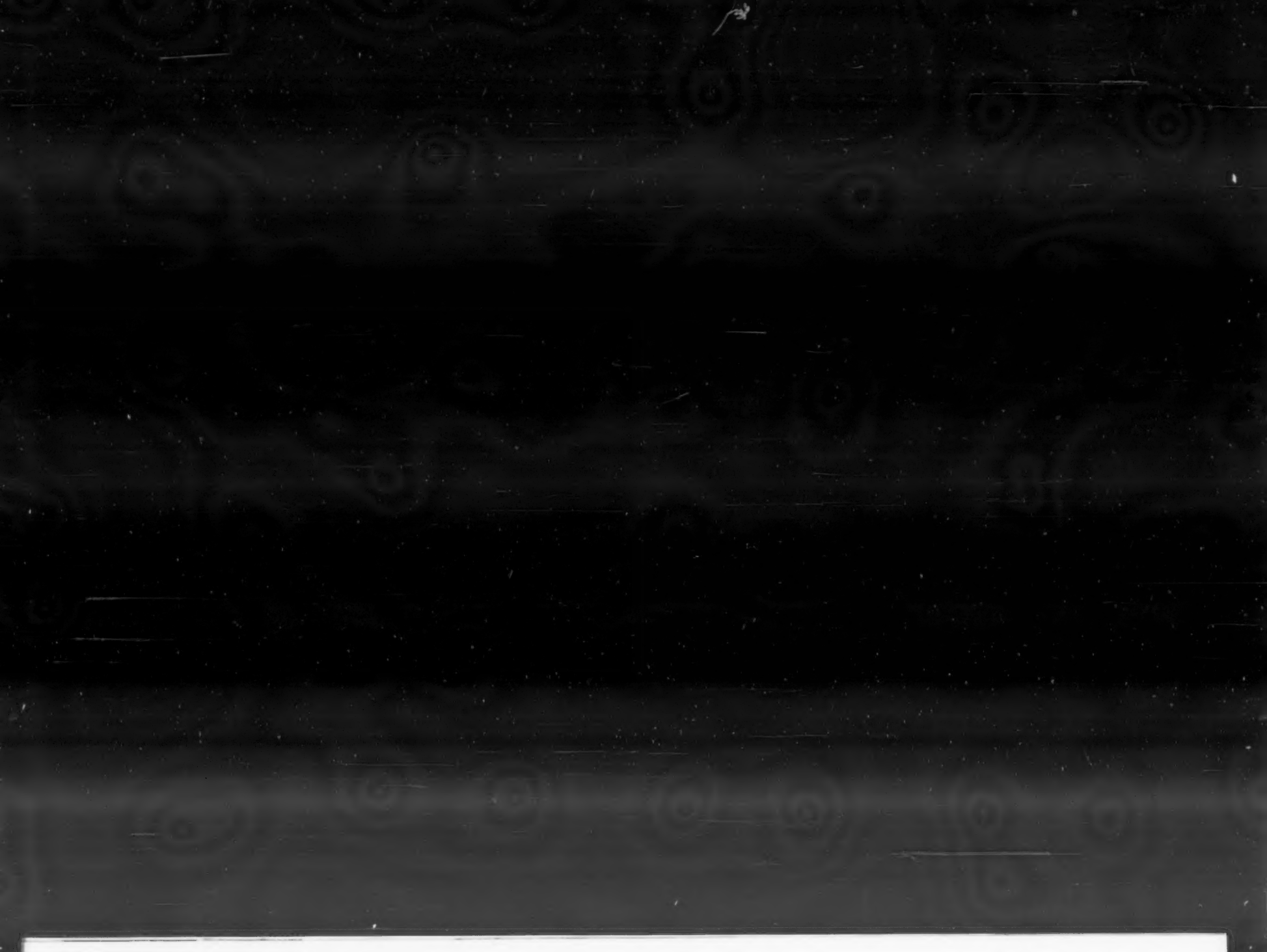
IF YOU WANT MORE DATA

If you want data on any single subgroup or 2- or 4-digit industry, FACTORY can provide free a spectrum of values totaling 15 plotting points: minimum, maximum, median, quartile, and decile points. Your request (to the Editor, FACTORY, 330 W. 42nd St., New York 36) should state which single breakdown you want—by industry code if possible.

In the chart below, items with checkmarks are to be found in the summary tabulation on the pullout. Items with asterisks are available on request.

	Grand Total	FACTORY's Group	Major 21 SIC Group	Selected 85 SIC Group
Total net sales	✓	✓	✓	✓
Total cost of goods sold	✓	✓	✓	✓
Total net profits	*	*	*	*
Total gross property	✓	✓	✓	✓
Total net property	✓	✓	✓	✓
Total maintenance and repair	✓	✓	✓	✓

	15 plotting points					
	Averages	Minimums	Decile points	Quartiles	Medians	Maximums
Maintenance as per cent of net sales	✓	✓	*	✓	✓	✓
" " " " goods sold	*	*	*	✓	✓	*
" " " " net profits	*	*	*	*	*	*
" " " " gross property	*	*	*	✓	✓	*
" " " " net property	*	*	*	*	*	*
Net property as per cent of gross property	*	*	*	*	*	*
Gross property as per cent of goods sold	*	*	*	*	*	*



FACTORY's Maintenance Cost Guide . . . Yardsticks fo

Industry Classification		Number of Companies in Group	Spent for Maintenance and Repair ($1000's)	Net Sales ($1000's)	Cost of Goods Sold ($1000's)	Gross Property ($1000's) [4]	Net Propert ($1000
Code Number	Description						
GRAND TOTAL		687	$7,518,228	$182,247,734	$136,617,199	$115,168,474	$62,257,4
FACTORY'S MANUFACTURING GROUPS [2]							
1	Heavy process	165	$4,060,265	$ 67,249,775	$ 47,046,743	$ 73,806,265	$38,799,1
2	Light process	191	814,592	39,426,230	29,766,736	13,008,748	7,448,6
3	Heavy fabrication	129	1,829,110	45,425,483	37,032,647	16,724,040	9,565,1
4	Light fabrication	145	603,114	22,115,921	17,001,629	8,469,199	4,609,1
5	Benchwork	57	211,147	8,030,325	5,769,444	3,160,222	1,835,3
MAJOR SIC MANUFACTURING GROUPS [3]							
19	Ordnance & accessories	2	$ 3,503	$ 164,792	$ 135,646	$ 30,222	$ 14,5
20	Food & kindred products	82	412,871	22,833,633	17,824,675	6,113,786	3,414,9
21	Tobacco products	14	18,959	3,786,881	3,074,125	452,609	271,5
22	Textile mill products	28	72,831	3,032,975	2,535,403	1,447,535	835,9
23	Apparel & finished products	15	18,024	905,315	728,609	314,594	154,2
24	Lumber	4	11,175	409,564	336,460	144,379	83,2
25	Furniture	4	3,583	207,179	157,619	78,964	42,9
26	Paper & allied products	26	242,783	4,294,313	3,023,868	3,935,402	2,300,5
27	Printing & publishing	9	10,445	600,450	387,570	229,288	113,7
28	Chemical & allied products	84	675,767	15,589,390	10,194,495	12,555,187	6,619,7
29	Petroleum refining & products	33	1,190,600	29,279,514	19,403,756	38,255,109	20,788,9
30	Rubber products	10	152,544	4,888,532	3,760,331	2,176,923	1,017,4
31	Leather & leather products	9	13,734	972,837	695,871	207,038	108,6
32	Stone, clay, & glass products	34	222,065	4,031,517	2,749,444	3,577,049	2,098,4
33	Primary metals	57	2,006,025	20,606,919	15,380,411	19,523,143	9,542,8
34	Fabricated metal products	29	151,062	4,741,020	3,806,887	2,307,018	1,367,8
35	Machinery, except electrical	85	379,348	12,008,894	8,850,923	5,533,022	3,144,2
36	Electrical machinery	48	256,388	12,542,480	9,765,860	3,863,116	2,058,6
37	Transportation equipment	78	1,626,466	38,882,931	32,052,817	13,492,555	7,731,7
38	Scientific & other instruments	22	29,779	1,574,444	1,090,022	515,824	297,9
39	Miscellaneous manufacturing	14	20,276	894,154	662,407	415,711	249,0
SELECTED SIC INDUSTRY GROUPS [3]							
2010	Meat products	8	$ 81,362	$ 6,858,645	$ 5,817,727	$ 1,018,402	$ 555,2
2020	Dairy products	7	76,002	3,519,603	2,726,774	1,114,615	561,1
2030	Canning & preserving	12	54,595	2,983,455	2,251,626	862,933	498,4
2041	Flour; grain-mill products	4	16,018	1,123,179	900,910	309,571	183,0
2043	Cereal preparations	3	13,558	752,243	595,499	191,889	118,1
2051	Bread & bakery products	5	21,608	753,737	462,002	279,927	132,1
2052	Biscuits	3	24,466	737,264	470,378	337,831	211,8
2060	Sugar	8	24,621	861,246	766,365	386,136	204,3
2070	Confectionery	4	4,971	422,735	243,577	131,558	62,4
2082	Malt liquors	6	15,163	414,937	276,850	252,599	150,2
2085	Distilled liquors	7	24,018	2,389,553	1,910,390	564,301	362,3
2086	Bottled, canned soft drinks	7	35,671	552,518	235,594	233,501	132,6
2090	Misc. food preparations	8	20,818	1,464,518	1,166,983	430,523	242,6
2210,-20	Broad fabrics, cotton & synth.	7	50,949	1,917,874	1,600,941	886,000	523,6
2230	Broad fabrics, wool	6	11,159	554,611	493,954	287,290	155,5
2250	Knitting mills	6	2,072	159,110	115,459	64,703	31,9
2270	Floor-covering mills	5	6,554	279,650	222,183	179,985	107,6
2290	Misc. textile goods	4	2,097	121,730	102,866	29,557	17,1
2600 [9]	Paper & allied products	14	127,724	2,417,344	1,843,737	2,288,526	1,379,2
2640	Converted paper, paperboard	8	33,948	690,987	486,151	682,529	419,3
2650	Paperboard containers, boxes	4	81,111	1,185,982	693,980	964,347	501,8
2810	Inorganic, organic chemicals	24	438,006	7,669,314	5,189,045	7,741,417	3,946,4
2820 [9]	Plastics; synth. rubber & resins	6	70,715	1,540,715	1,035,134	1,233,943	667,7

[1] Source: Reports filed with Securities & Exchange Commission in compliance with "Regulation S-X" (Superintendent of Documents, Washington 25).

[2] For details, see page 214.

[3] Based on "Standard Industrial Classification Manual" (Superintendent of Documents, Washington 25).

[4] Property, plant, and equipment, usually valued at acquisition cost.

Turn the page

cks for you, based on spending by 687 manufacturers[1] — 1957

Net Property ($1000's)[5]	Maintenance Cost as Percent of Net Sales						Maintenance Cost as Percent of Cost of Goods Sold			Maintenance Cost as Percent of Gross Property		
	Average (Arith. mean)	Minimum	Lower Quartile[6]	Median (Mid-point)	Upper Quartile[7]	Maximum	Lower Quartile[6]	Median	Upper Quartile[7]	Lower Quartile[6]	Median	Upper Quartile[7]
$62,257,418	4.12%	.04%	1.37%	2.45%	4.25%	17.46%	1.91%	3.18%	5.74%	3.97%	5.89%	8.53%
$38,799,184	6.03%	.83%	3.39%	5.01%	7.65%	15.92%	4.76%	7.25%	10.87%	3.95%	5.80%	7.90%
7,448,628	2.06	.04	.99	1.84	3.08	10.38	1.45	2.56	4.37	3.44	5.05	7.20
9,565,192	4.02	.34	1.46	2.08	3.24	17.46	1.83	2.60	4.14	5.10	6.97	10.25
4,609,103	2.72	.12	1.35	2.09	3.25	8.62	1.88	2.75	4.29	4.37	6.46	9.43
1,835,311	2.62	.19	.89	1.49	2.74	8.48	1.06	1.98	3.68	3.40	5.34	10.50
$ 14,573	2.12%	1.98%	n.c.[8]	n.c.[8]	n.c.[8]	2.76%	n.c.[8]	n.c.[8]	n.c.[8]	n.c.[8]	n.c.[8]	n.c.[8]
3,414,995	1.80	.04	1.06%	1.73%	3.06%	10.38	1.35%	2.54%	4.37%	3.88%	5.77%	7.28%
271,570	.50	.15	.63	.84	1.49	3.30	.78	1.09	1.92	3.92	4.54	5.40
835,936	2.40	.49	1.29	1.98	2.36	6.97	1.81	2.39	3.02	2.81	4.02	5.12
154,262	1.98	.22	.41	.95	2.14	4.13	.58	1.25	2.72	3.04	4.83	6.27
83,204	2.73	.88	n.c.	1.98	n.c.	4.13	n.c.	2.47	n.c.	n.c.	8.48	n.c.
42,922	1.73	.49	n.c.	1.74	n.c.	2.11	n.c.	2.40	n.c.	n.c.	4.57	n.c.
2,300,527	5.63	1.05	4.03	4.97	7.11	8.58	5.33	6.58	9.21	4.63	5.71	8.01
113,762	1.74	.59	1.09	1.81	2.96	3.73	2.55	2.71	3.03	4.37	4.96	5.32
6,619,725	4.32	.32	1.24	3.07	5.56	13.59	2.21	5.59	7.74	3.78	5.04	6.25
20,788,991	4.06	1.46	3.05	3.96	5.27	8.96	4.61	6.35	8.67	2.15	2.79	3.98
1,017,429	3.12	2.16	2.61	3.06	3.26	4.07	3.42	3.80	4.26	6.58	7.90	9.03
108,670	1.41	.49	.67	1.89	2.19	3.08	.99	2.16	2.70	5.35	6.30	10.25
2,098,443	5.48	1.98	3.57	5.78	7.08	11.31	5.19	8.42	11.53	4.44	5.58	7.92
9,542,893	9.67	.83	3.97	6.26	9.59	15.92	5.00	8.18	12.36	6.97	9.60	11.60
1,367,845	3.18	.12	1.36	2.79	3.97	8.62	1.95	3.49	4.70	4.99	6.08	10.02
3,144,220	3.15	.34	1.44	2.03	3.13	17.46	1.94	2.70	4.11	4.51	6.02	7.47
2,058,617	2.04	.19	1.05	1.97	2.57	5.04	1.34	2.57	3.64	4.31	6.81	10.18
7,731,757	4.18	.44	1.42	2.10	3.08	8.84	1.66	2.54	3.75	6.19	9.48	13.80
297,979	1.89	.55	.95	1.61	2.56	4.27	1.38	2.02	3.42	3.22	4.51	6.45
249,098	2.27	.54	.80	2.05	3.23	5.15	1.57	2.86	4.47	3.26	5.23	6.95
$ 555,265	1.18%	.22%	.87%	1.06%	1.17%	1.51%	.89%	1.12%	1.25%	6.89%	7.79%	9.07%
561,194	2.15	1.89	n.c.	2.11	n.c.	3.83	n.c.	2.82	n.c.	n.c.	6.59	n.c.
498,443	1.83	.04	1.07	1.84	2.98	4.92	1.55	2.29	3.78	5.00	6.22	7.20
183,066	1.42	.95	n.c.	1.38	n.c.	2.88	n.c.	1.74	n.c.	n.c.	5.34	n.c.
118,121	1.80	.61	n.c.	1.35	n.c.	2.14	n.c.	1.78	n.c.	n.c.	4.47	n.c.
132,496	2.81	2.20	n.c.	3.06	n.c.	3.66	n.c.	5.04	n.c.	n.c.	8.17	n.c.
211,817	3.32	1.65	n.c.	3.01	n.c.	4.09	n.c.	4.94	n.c.	n.c.	6.37	n.c.
204,359	2.86	1.16	2.53	3.26	4.09	8.64	2.96	3.48	4.69	6.09	6.84	7.14
62,441	1.17	.62	n.c.	1.12	n.c.	1.83	n.c.	1.90	n.c.	n.c.	3.98	n.c.
150,210	3.65	1.73	n.c.	3.72	n.c.	4.78	n.c.	6.15	n.c.	n.c.	5.60	n.c.
362,346	1.00	.24	n.c.	1.06	n.c.	1.64	n.c.	1.42	n.c.	n.c.	3.94	n.c.
132,616	6.34	.54	n.c.	1.98	n.c.	10.38	n.c.	2.70	n.c.	n.c.	5.70	n.c.
242,621	1.42	.34	.83	1.41	1.72	3.60	1.12	1.67	2.62	3.21	3.70	4.42
523,634	2.60	1.24	n.c.	2.36	n.c.	6.97	n.c.	2.64	n.c.	n.c.	5.12	n.c.
155,599	2.01	1.75	n.c.	2.05	n.c.	2.63	n.c.	2.47	n.c.	n.c.	4.02	n.c.
31,908	1.30	.94	n.c.	1.24	n.c.	3.04	n.c.	2.39	n.c.	n.c.	3.00	n.c.
107,637	2.34	1.81	n.c.	1.98	n.c.	3.22	n.c.	2.55	n.c.	n.c.	3.37	n.c.
17,158	1.72	.49	n.c.	2.00	n.c.	2.09	n.c.	2.37	n.c.	n.c.	10.04	n.c.
1,379,275	5.28	3.17	4.25	5.28	7.35	8.58	5.37	6.58	9.21	4.91	5.67	6.19
419,366	4.91	1.05	3.67	4.97	5.94	7.31	5.33	7.25	7.67	4.15	4.73	5.71
501,886	6.83	4.03	n.c.	6.21	n.c.	7.16	n.c.	10.79	n.c.	n.c.	8.72	n.c.
3,946,448	5.60	1.48	4.52	5.78	6.98	9.42	6.27	8.70	10.62	4.80	5.91	6.64
667,753	4.59	2.07	n.c.	4.75	n.c.	6.04	n.c.	7.07	n.c.	n.c.	6.18	n.c.

[5] Gross property less reserves for depreciation, depletion, amortization.
[6] 25% of all manufacturers are below this value.
[7] 25% of all manufacturers are above this value.
[8] Not computable.
[9] Partial total for group. Remainder in code(s) of same industry immediately following.

Pull out

FACTORY's Maintenance Cost Guide (cont.)...Yardsticks for you, based on spendi

Industry Classification		Number of Companies in Group	Spent for Maintenance and Repair* ($1000's)	Net Sales ($1000's)	Cost of Goods Sold ($1000's)	Gross Property ($1000's)[4]	Net Property ($1000's)[5]	Ave (A m
Code Number	Description							
2823	Cellulosic man-made fibers	4	$ 33,047	$ 542,732	$ 433,057	$ 895,501	$ 410,280	6.
2830	Drugs	18	30,633	1,970,829	830,416	698,444	433,995	1.
2841	Soap & detergents	6	30,018	2,045,382	1,370,247	775,951	508,128	1.
2844	Perfumes & cosmetics	6	1,331	224,718	134,192	31,565	21,742	.
2850	Paints & varnishes	5	7,241	447,196	358,233	182,279	101,566	1.
2870	Agricultural chemicals	6	31,769	405,943	307,121	369,554	212,607	7.
2890	Misc. chemical products	9	33,007	742,561	537,050	626,533	317,206	4
2910	Petroleum refining	29	1,169,247	28,907,954	19,100,390	38,003,815	20,634,541	4
2950	Paving & roofing materials	4	21,353	371,560	303,366	251,294	154,450	5
3210	Flat glass	8	109,530	1,875,553	1,284,716	1,343,740	759,820	5
3240	Hydraulic cement	8	33,597	424,456	253,457	865,081	546,028	7
3250	Structural clay products	6	15,774	252,447	171,046	252,690	124,311	6
3270	Gypsum & plaster products	3	22,426	420,521	266,618	409,635	263,959	5
3290	Non-metallic mineral products	9	40,738	1,058,540	773,607	705,903	404,325	3
3312	Blast furnaces, steel works	23	1,608,375	14,032,567	10,318,557	13,766,383	6,314,412	11
3313	Electrometallurgic products	6	12,629	308,965	218,827	159,414	101,569	4
3320	Iron & steel foundries	3	14,910	223,369	171,067	179,056	95,982	6
3330	Prim. nonfer. smelt'g., refin'g.	12	310,141	4,518,335	3,392,726	4,734,097	2,640,997	6
3340	Sec. nonfer. smelt'g., refin'g.	1	16,340	366,081	326,375	110,292	56,741	4
3350	Nonferrous forming mills	9	34,665	953,846	782,123	493,817	288,763	3
3390	Miscellaneous primary metal	3	8,965	203,756	170,736	80,084	44,429	4
3410	Cans	3	78,238	2,140,983	1,809,999	1,323,476	846,485	3
3420	Cutlery, hand tools, hardware	5	6,241	363,940	181,805	104,350	51,642	1
3430	Heating & plumbing	6	23,926	974,066	778,147	431,779	234,544	2
3440	Fabricated structural metal	4	9,170	362,077	301,131	118,690	58,436	2
3450	Screws, nuts, bolts	2	2,628	66,411	50,724	33.929	15,273	3
3460	Metal stampings	4	19,831	461,629	396,984	160,580	88,947	4
3480	Misc. fabr. wire products	2	7,041	166,807	132,405	57,134	29,075	4
3490	Misc. fabr. metal products	3	3,987	205,107	155,692	77,080	43,443	1
3510	Engines & turbines	7	16,830	775,422	622,626	259,925	146,814	2
3520	Farm machinery	7	81,474	2,458,106	1,995,884	1,212,536	635,879	3
3530[9]	Constr., mining, mtl.-hdlg. equ.	11	44,694	1,580,628	1,193,032	537,945	361,539	2
3533	Oil field machinery & equipment	6	25,576	817,927	606,412	345,863	202,283	3
3541,-2	Machine tools	13	21,472	818,208	609,765	302,503	159,051	2
3548	Other metalworking machinery	5	10,667	381,875	307,450	122,885	69,588	2
3550	Special industrial machinery	8	8,491	623,022	546,307	260,570	152,091	1
3560[9]	General industrial machinery	3	2,140	118,528	90,937	30,937	18,748	1
3561	Pumps & compressors	9	15,018	777,755	537,260	218,766	125,394	1
3562	Ball & roller bearings	3	22,224	336,579	239,882	172,224	73,054	6
3570	Office machines	10	123,463	2,880,388	1,746,221	1,933,390	1,128,925	4
3580	Service-industry machinery	3	7,299	440,456	355,147	135,478	70,854	1
3610	Elec. transm. & distr. equip.	6	144,855	6,697,801	5,120,643	2,296,871	1,142,348	2
3620	Electrical industrial apparatus	7	14,369	708,703	499,499	227,190	132,503	2.
3630	Household appliances	9	20,603	777,949	664,623	221,589	148,284	2.
3640	Lighting & wiring equipment	3	4,574	206,723	176,966	60,818	37,711	2.
3650	Radio & television sets	14	55,019	3,460,482	2,728,430	803,390	471,338	1.
3670	Electronic components, acc'ries	6	4,435	215,326	178,382	47,957	29,084	2.
3690	Misc. electrical equipment	3	12,533	475,496	397,317	205,301	97,349	2.
3711	Motor vehicles	12	1,243,863	21,708,679	17,145,162	9,743,800	5,687,147	5.
3714	Motor vehicle parts, acc'ries	22	80,857	2,626,149	2,150,311	851,070	500,451	3.
3720	Aircraft & parts	24	207,809	11,782,736	10,451,832	1,505,053	800,948	1.
3730	Ship & boat building	3	5,996	299,766	265,200	85,541	42,277	2.
3740[9]	Railroad equipment	17	87,941	2,465,601	2,040,312	1,307,091	700,934	3.
3820	Instruments: meas., contr., indic.	7	7,746	568,955	389,225	171,302	115,208	1.
3830	Optical instruments, lenses	2	3,918	130,779	77,179	62,378	30,433	3.
3840	Medical instruments	4	10,121	361,180	229,871	137,844	72,274	2.
3860	Photo. equipment & supplies	4	4,889	322,344	245,785	78,769	49,103	1.
3870	Watches & clocks	5	3,105	191,186	147,962	65,531	30,961	1.
3910,-60	Jewelry; silver & plated wear	4	3,527	160,797	126,918	52,084	31,667	2.
3940	Toys, athletic goods	4	2,692	199,775	148,294	40,441	19,852	1.
3950	Pens & pencils	3	929	67,649	31,588	27,064	16,057	1.
3980,-90	Other misc. mfg. industries	3	13,128	465,933	355,607	296,122	181,522	2.

ending by 687 manufacturers—1957

Maintenance Cost as Percent of Net Sales						Maintenance Cost as Percent of Cost of Goods Sold			Maintenance Cost as Percent of Gross Property		
Average (Arith. mean)	Minimum	Lower Quartile[6]	Median (Mid-point)	Upper Quartile[7]	Maximum	Lower Quartile[6]	Median	Upper Quartile[7]	Lower Quartile[6]	Median	Upper Quartile[7]
6.08%	5.14%	n.c.	5.99%	n.c.	10.43%	n.c.	7.47%	n.c.	n.c.	3.85%	n.c.
1.55	.32	.80%	.99	1.84%	3.07	1.70%	2.76	4.56%	3.10	4.67	5.43%
1.46	1.00	n.c.	1.48	n.c.	1.84	n.c.	2.26	n.c.	n.c.	4.69	n.c.
.59	.35	n.c.	.72	n.c.	1.41	n.c.	1.38	n.c.	n.c.	4.63	n.c.
1.62	.81	n.c.	.97	n.c.	2.47	n.c.	1.36	n.c.	n.c.	3.78	n.c.
7.87	4.95	n.c.	8.27	n.c.	13.59	n.c.	11.28	n.c.	n.c.	9.89	n.c.
4.44	1.34	4.24	4.49	4.87	5.71	55.59	6.15	7.74	4.04	6.18	6.63
4.04	2.12	3.05	3.89	4.77	6.87	4.61	6.33	8.67	2.11	2.73	3.46
5.74	1.46	n.c.	6.45	n.c.	8.96	n.c.	8.43	n.c.	n.c.	7.91	n.c.
5.84	1.98	4.67	6.31	7.08	9.29	6.02	9.29	9.34	6.89	8.28	8.39
7.92	5.90	6.67	8.86	10.06	11.31	11.55	12.15	15.86	3.19	4.65	4.95
6.25	2.81	n.c.	4.53	n.c.	9.15	n.c.	8.15	n.c.	n.c.	5.31	n.c.
5.33	4.99	n.c.	5.78	n.c.	5.99	n.c.	8.42	n.c.	n.c.	5.58	n.c.
3.85	2.30	2.94	4.22	5.01	6.45	3.97	5.19	7.18	6.00	6.72	7.92
11.45	.83	5.83	9.43	11.15	15.92	8.10	11.59	14.48	7.76	9.87	12.90
4.08	2.28	n.c.	4.28	n.c.	5.91	n.c.	5.86	n.c.	n.c.	9.70	n.c.
6.68	4.47	n.c.	6.26	n.c.	7.47	n.c.	8.18	n.c.	n.c.	10.40	n.c.
6.86	2.59	6.19	8.42	9.57	11.46	6.76	11.00	13.28	6.54	9.26	9.60
4.46	4.46	n.c.	n.c.	n.c.	4.46	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.
3.63	1.86	2.20	3.47	4.61	9.59	2.71	4.16	5.43	5.57	6.97	7.33
4.40	2.07	n.c.	5.52	n.c.	6.09	n.c.	6.33	n.c.	n.c.	11.48	n.c.
3.64	3.37	n.c.	3.89	n.c.	4.20	n.c.	4.57	n.c.	n.c.	6.08	n.c.
1.71	.58	n.c.	2.25	n.c.	4.09	n.c.	3.49	n.c.	n.c.	6.02	n.c.
2.46	.12	n.c.	2.61	n.c.	4.47	n.c.	3.18	n.c.	n.c.	5.89	n.c.
2.53	1.31	n.c.	1.48	n.c.	2.92	n.c.	1.95	n.c.	n.c.	6.46	n.c.
3.96	3.60	n.c.	n.c.	n.c.	4.41	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.
4.29	.90	n.c.	6.50	n.c.	8.62	n.c.	7.65	n.c.	n.c.	11.89	n.c.
4.21	3.97	n.c.	n.c.	n.c.	4.32	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.
1.95	1.36	n.c.	1.82	n.c.	2.67	n.c.	2.50	n.c.	n.c.	4.32	n.c.
2.17	.91	n.c.	1.70	n.c.	4.23	n.c.	1.94	n.c.	n.c.	5.55	n.c.
3.31	2.00	n.c.	2.97	n.c.	5.21	n.c.	3.71	n.c.	n.c.	5.63	n.c.
2.83	.95	1.44	2.03	3.28	6.64	1.91	2.64	5.21	4.72	6.17	8.30
3.12	.90	n.c.	2.11	n.c.	17.46	n.c.	3.07	n.c.	n.c.	6.54	n.c.
2.62	.51	1.68	2.42	3.17	3.88	2.27	3.73	4.01	3.67	5.86	6.91
2.80	.95	n.c.	2.58	n.c.	4.78	n.c.	3.25	n.c.	n.c.	7.15	n.c.
1.36	1.00	1.14	1.66	1.80	3.65	1.60	1.91	2.18	3.07	5.19	5.36
1.71	1.64	n.c.	1.72	n.c.	2.00	n.c.	2.30	n.c.	n.c.	7.54	n.c.
1.93	.34	1.31	1.37	2.47	3.92	1.83	2.29	3.97	4.57	6.20	7.07
6.60	3.37	n.c.	4.19	n.c.	8.58	n.c.	5.20	n.c.	n.c.	11.58	n.c.
4.27	.89	1.49	2.40	3.16	8.48	2.49	3.79	5.52	3.77	5.46	7.13
1.66	.42	n.c.	1.70	n.c.	2.34	n.c.	2.17	n.c.	n.c.	5.03	n.c.
2.15	1.53	n.c.	2.42	n.c.	3.09	n.c.	3.07	n.c.	n.c.	8.22	n.c.
2.03	1.14	n.c.	1.83	n.c.	2.94	n.c.	2.86	n.c.	n.c.	6.92	n.c.
2.65	.27	1.82	2.45	2.57	5.04	2.32	2.71	3.15	6.46	7.87	10.79
2.20	1.84	n.c.	2.19	n.c.	2.53	n.c.	2.46	n.c.	n.c.	7.63	n.c.
1.58	.19	.59	1.12	2.92	4.44	.78	1.68	3.64	3.61	6.46	10.97
2.06	.71	n.c.	2.02	n.c.	3.84	n.c.	2.32	n.c.	n.c.	6.60	n.c.
2.64	.51	n.c.	1.97	n.c.	3.51	n.c.	2.57	n.c.	n.c.	4.09	n.c.
5.72	.63	1.20	1.52	2.03	8.64	1.51	1.66	2.25	5.29	6.64	10.25
3.20	.44	1.75	2.92	4.40	6.65	2.06	3.73	4.80	7.52	10.65	12.56
1.83	.49	1.30	1.97	2.40	3.25	1.41	2.12	2.67	10.04	13.80	17.13
2.00	.98	n.c.	1.95	n.c.	2.28	n.c.	2.29	n.c.	n.c.	5.03	n.c.
3.56	1.20	2.12	2.57	4.75	8.84	2.66	3.39	5.77	5.51	6.62	8.01
1.36	.72	n.c.	1.03	n.c.	4.27	n.c.	1.61	n.c.	n.c.	3.88	n.c.
3.00	2.97	n.c.	n.c.	n.c.	3.03	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.
2.79	.95	n.c.	1.83	n.c.	3.27	n.c.	2.87	n.c.	n.c.	4.61	n.c.
1.52	.55	n.c.	1.45	n.c.	1.93	n.c.	1.92	n.c.	n.c.	4.30	n.c.
1.62	.66	n.c.	1.78	n.c.	2.56	n.c.	2.21	n.c.	n.c.	4.70	n.c.
2.19	.54	n.c.	2.05	n.c.	4.84	n.c.	3.14	n.c.	n.c.	9.05	n.c.
1.35	.78	n.c.	1.37	n.c.	5.13	n.c.	1.84	n.c.	n.c.	6.95	n.c.
1.37	.80	n.c.	1.01	n.c.	2.09	n.c.	2.30	n.c.	n.c.	3.26	n.c.
2.81	2.06	n.c.	3.23	n.c.	5.15	n.c.	4.02	n.c.	n.c.	5.30	n.c.

New cost facts on lubricants . . .
. . . and how they affect FACTORY's Index

INDEX NUMBERS

Year or Month	Lubricants		Materials		Equipment		Cost Index	
	Revised	Old	Revised	Old	Revised	Old	Revised	Old
1949	92.5	63.3	112.1	109.4	111.9	110.8	112.0	111.2
1950	95.8	69.9	119.4	117.0	118.4	117.4	117.5	116.8
1951	116.9	92.1	136.4	134.1	132.3	131.4	130.6	130.0
1952	116.2	89.2	135.6	133.1	136.6	135.6	134.8	134.1
1953	112.8	75.7	138.2	134.8	143.1	141.7	140.9	139.9
1954	109.8	63.9	141.0	136.7	146.2	144.5	144.2	143.0
1955	110.8	65.8	148.6	144.4	152.8	151.1	150.1	148.9
1956	117.3	78.6	160.9	157.3	163.2	161.8	159.7	158.7
1957	122.2	87.8	170.9	167.7	171.1	169.9	167.5	166.0
1958								
Jan.	122.5	87.6	174.4	171.2	173.1	171.8	168.9	168.0
Feb.	122.5	87.2	174.2	170.9	172.2	170.9	168.4	167.5
Mar.	122.5	84.4	173.9	170.4	173.1	171.7	168.6	167.6
Apr.	122.5	83.7	173.3	169.7	172.8	171.4	168.6	167.6
May	122.5	81.1	172.4	168.6	172.9	171.4	169.1	168.0
June	122.5	81.1	172.6	168.7	173.2	171.6	169.3	168.2
July	123.0	80.1	172.8	168.8	173.1	171.5	169.9	168.8
Aug.	123.0	80.1	173.1	169.1	173.6	172.0	169.9	168.8
Sep.	123.0	80.1	172.8	168.8	173.6	172.0	170.3	169.2
Oct.	123.0	80.1	174.0	169.7	174.0	172.1	170.8	169.3
Nov.	123.0	80.1	173.9	169.9	175.2	173.6	171.7	170.6
Dec.	123.0	—	173.9	—	175.7	—	172.1	—

Now—a More Exact Cost Index

THERE'S A NEW method of estimating the price of lubricants in FACTORY's Cost Index. The difference isn't great in the over-all Index. But it's considerable in the lubricants column and noticeable in the materials column above. (See also Cost Index, page 57.)

Here's what's happened:

About two years ago plant people and oil-company people began to feel that the BLS wholesale prices used for lubricants didn't reflect what industry was paying. So FACTORY went to the Bureau, talked with the experts (statisticians and oil men), decided to collect our own price data for lubricants.

So from now on oil companies will give us a more realistic price average for a representative group of branded industrial lubricants. Also they've given us historical figures so we could revise the lubricants index and thus the materials component of the equipment index. In turn we've been able to adjust the entire Cost Index back to 1949 (where we first projected it from a 1947-49 base). The 1947 and 1948 figures aren't affected.

How the change hits you—The revision has a marked effect on the lubricants index and the materials column. But the equipment index and the over-all Cost Index change little. The new lubricants figures account for less than 1% change in the Index levels.

Thus we see no need for you to correct past statistics unless you've been calculating within 1%. If you want to adjust past records, we've provided the tabulations above. It shows old and new values for lubricants, materials, equipment, and the over-all Index.

Helping five years—The Index has just passed its fifth anniversary as a valuable tool for plant management and maintenance men. Our recent nation-wide survey (September 1958) shows that one of every three respondents using any index for adjusting maintenance costs uses FACTORY's Index.

Ever since January 1954 we've kept an eye on the validity of the figures. We've talked and written to treasurers, controllers, plant managers, maintenance men. They've suggested that we add other materials to our list of 39 items or groups of related items; that we alter some of our weighting factors; that we check the accuracy of prices on one material or another.

In every instance we've studied the suggestion. We've checked and rechecked our basic list of 39 materials—and found them truly representative. And we've seen confirmation of our over-all labor-materials weighting factor in our September survey.

We're sure you'll continue to find FACTORY's Cost Index a useful statistical tool in measuring the effect of changes in the costs of materials and labor on the cost of plant maintenance.

Solving Your Plant Problems by

Blind chance will do you wrong if you let it. But today you can make it work for you—not against you—with a simulation technique called Monte Carlo.

AT FIRST GLANCE, any relation between a roulette wheel and the hard-headed business of running a plant seems downright fanciful.

But as many a plant executive knows, chance plays strange tricks. Machines break down unexpectedly. Workers don't show up. Shipments arrive late. And bottlenecks turn up in key operations. Sometimes these events seem to be a giant conspiracy to keep plant executives from doing the best job possible.

Chance events like these are a part of everyday life. Until recently, about all the most skillful plant manager could do was to prepare his defenses against them as best he could.

Today, though, with an easy-to-use, plant-tested simulation technique known as Monte Carlo, a plant executive can soften the impact of unlucky events—even make chance do useful work in solving some problems that defy statement in mathematical terms. In fact, Monte Carlo is the only way to solve some problems. And it can be used to simulate future sequences of events, thus test various alternate plans on paper without disturbing the physical process.

WHAT MONTE CARLO DOES

Monte Carlo will handle a wide variety of problems. For example, here at Lukens Steel we've used it to do these jobs:

. . . *Estimate the effect* of unpredictable variables in fabrication of steel plate, thus indicate size allowances for lowest total costs.

. . . *Tell us whether* we'd gain or lose by stocking larger plates from which to make unpredictable custom fabrications.

. . . *Help us reduce* the "bunching" of furnace rebuilds.

. . . *Guide us in sequencing* weekly work loads and absentee man-hours.

. . . *Choose between* a two-man, two-machine operation on the one hand, and a one-man, two-machine operation on the other, with the chance of waiting time figured in.

In addition, we now see other possibilities for using Monte Carlo:

. . . *To find answers* to non-standard as well as standard waiting-line problems.

. . . *To set up production schedules* that take various in-process delays into account.

. . . *To schedule* a repair and preventive maintenance program, including optimum inspection periods, spare-parts inventory, and assignment of crews.

. . . *To balance* input and output when capacities are affected by various product mixes.

Monte Carlo is just one of the many tools in the kit of the Operations Research (OR) man. Its versatility of attack is gained somewhat at the expense of rigor, because Monte Carlo does not have the generality and elegance of some of the other OR techniques. As a willing workhorse, however, Monte Carlo permits its user to include variables up to the limits of available data and the patience and imagination of the analyst. Fortunately the advent of the electronic computer has reduced the slow, tedious task of carrying out the solution.

The primary importance of Monte Carlo is its usefulness as a simulation tool. Mechanical, electrical, and even hydraulic models have been used on occasion to simulate some industrial process. But Monte Carlo is probably the most general and certainly most used simulation device in industrial OR.

In the following pages you'll find a worked-through, simplified example of how a particular production process is simulated. Next, some problems Monte Carlo has solved for us at Lukens. Finally, some function areas of industry in which simulation can be useful.

WHAT SIMULATION IS

In most industrial processes several variables interact on some output or outputs of the system. Often at least some of these factors are "stochastic." That is, they involve a probability distribution rather than being constant through space or time.

If we can build up these key distributions empirically from actual or logically assumed data, we can generate an artificial sequence of events at random against which we can test certain policies. A large number of such random-sequence generations, drawn from the probability distributions describing the process, will tend to reflect the long-run behavior of the system being simulated.

Monte Carlo is like any other simulation model. That is, degrees of simplification or realism are possible, depending upon data availability and sensitivity of the solution to small changes in the model. But Monte Carlo is largely descriptive rather than analytical. In other words, rather than employ mathematics to represent a general solution, we approximate the answer systematically by running the simulated process a large number of times with the alternates under test. This way, the data, in a sense, "speak for themselves."

By PAUL GREEN and S. REED CALHOUN, Operations Research Team; and I. LANDIS HAINES, Industrial Engineering Department; Lukens Steel Company, Downington, Pa. (Mr. Green is no longer with Lukens.)

Simulation

HOW MONTE CARLO WORKS

Monte Carlo can best be explained by an example. The one that follows is hypothetical and over-simplified. Even so, it demonstrates the flexibility of the technique in coping with problems that include probabalistic factors.

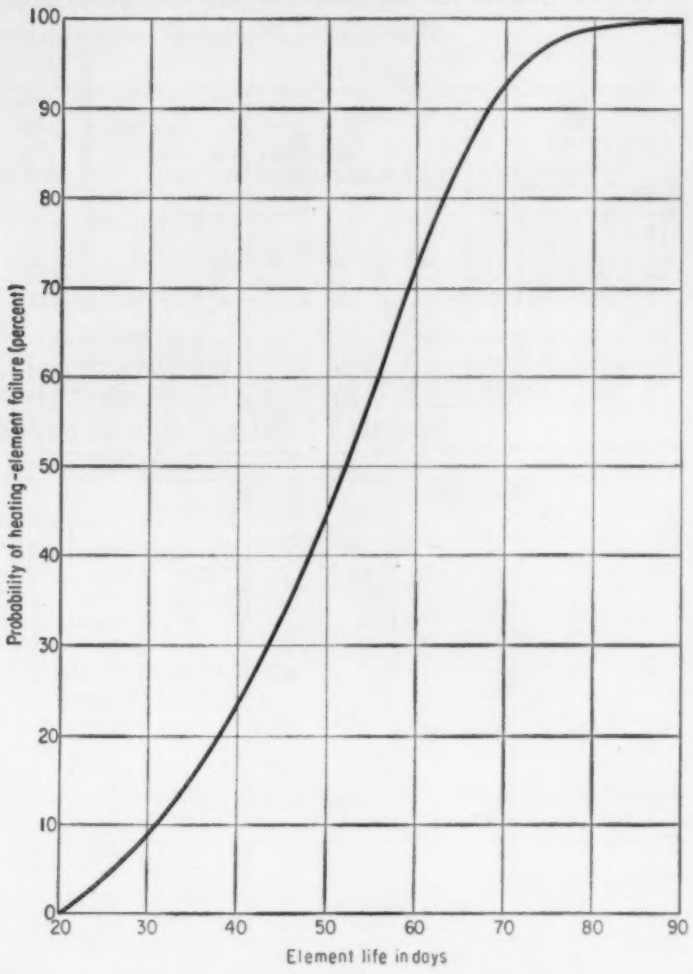
Take the Neverchip Enamel Company. It's in the business of producing small enameled metal parts. Parts pass through two large baking ovens for final hardening of the enamel. The ovens are in parallel, operate independently of each other. In addition, each oven contains three heating elements, which are subject to failure from time to time.

If one or more heating elements fail in Oven A or Oven B, that oven becomes inoperable during the repair period without affecting the operation of the other oven or the life remaining in the neighboring heating elements. During the repair period Neverchip would, of course, replace the burned-out element. But one or both of the two remaining elements, which still have some service life, could also be replaced during this same repair period with a less-than-proportional downtime.

Experience has shown the following: repair time for replacing one heating element—3 days; two heating elements—5 days; all three heating elements—6 days. If, during the repair period of Oven A, Oven B also goes down for repair, Neverchip will have a production bottleneck. This situation, when it occurs, will be called a double failure. Management is interested not only in the incidence of these double failures but also in their duration.

The maintenance engineer has collected data on the life distribution of heater elements in similar environments. These lives, given in terms of operating days, are reduced to a histogram. Although heating-element failures occur most often in the interval of 50 to 60 operating days, there is some chance that a heating element may last as long as 90 days —or fail in as few as 20 days. The resulting histogram thus shows the probabalistic nature mentioned earlier. By smoothing and cumulating the data in this histogram Neverchip can derive a curve that portrays the chance that a particular heating element, chosen at random, will fail before some designated length of life. This curve is shown in the graph above.

How heating-element age affects chance of failure



Three policies to weigh—Management is interested in evaluating three maintenance policies:

Alternate 1: When one heating element burns out, all three elements of the oven are replaced. Repair time, 6 days.

Alternate 2: When one heating element burns out, only that one is replaced. Repair time, 3 days.

Alternate 3: When one heating element burns out, the burned-out element is replaced, plus either one or both of the other elements if their accumulated operating time exceeds 50 days (individually), which is the average life of a heating element.

Now that the alternates have been laid out, management is interested in certain outputs or results of this little simulation. Under each policy management wants to know. . . .

. . . *What will be the average number of repairs per year* for the bank of two ovens and, on the average, how many days per year will be lost for repair?

. . . *What will be the expected number of double failures* on an annual basis, and the average number of days lost through double failures?

Turn the page

How to figure on three alternates for oven repair

Alternate 1 — Replace all heating elements at each failure

Oven A											Oven B								
Cycle	Rand. Nos. for Elements 1 2 3	Oper. Days	Delay Days	Repair Days	Cum. Oper. Days	Cum. Delay Days	Cum. Rep. Days	Day Down (End of)	Day On (End of)	Rand. Nos. for Elements 1 2 3	Oper. Days	Delay Days	Rep. Days	Cum. Oper. Days	Cum. Delay Days	Cum. Rep. Days	Day Down (End of)	Day On (End of)
1	02 11 48	22	0	6	22	0	6	22	28	27 32 66	42	0	6	42	0	6	42	48
2	11 17 62	32	0	6	54	0	12	60	66	62 75 87	56	0	6	98	0	12	104	110
3	97 98 51	52	0	6	106	0	18	118	124	40 26 88	41	0	6	139	0	18	151	157
4	63 36 93	46	0	6	152	0	24	170	176	29 97 85	43	0	6	182	0	24	200	206
5	75 49 96	52	0	6	204	0	30	228	234	25 24 53	40	0	6	222	0	30	246	252
14	41 64 34	45	0	6	550	0	84	628	634	07 17 16	28	0	6	591	6	84	675	681
15	45 91 03	24	0	6	574	0	90	658	664	33 91 17	36	0	6	627	6	90	717	723
16	26 60 18	37	0	6	611	0	96	701	707	71 79 91	60	0	6	687	6	96	783	789
17	80 12 23	32	0	6	643	0	102	739	745	65 80 65	57	4	6	744	10	102	846	856

Alternate 2 — Replace only failed element(s) at each failure

Oven A

Element History						Furnace History							
1		2		3									
Rand. No.	Life	Rand. No.	Life	Rand. No.	Life	Operating Days	Delay Days	Repair Days	Cum. Optg. Days	Cum. Del. Days	Cum. Rep. Days	Day Down (End of)	Day On (End of)
02	22	11	31	48	51	22	0	3	22	0	3	22	25
11	32		9		29	9	0	3	31	0	6	34	37
	23	17	36		20	20	0	3	51	0	9	57	60
	3		16	75	61	3	0	3	54	0	12	63	66
87	66		13		58	13	0	3	67	0	15	79	82
						43 Intervening Cycles Omitted							
	48		5	52	53	5	0	3	835	14	149	995	998
	43	69	59		48	43	0	3	878	14	152	1041	1044
55	54		16		5	5	0	3	883	14	155	1049	1052
	49		11	45	50	11	0	3	894	14	158	1063	1066
	38	42	49		39	38	0	3	932	14	161	1104	1107

Oven B

27	42	32	44	66	58	42	0	3	42	0	3	42	45
62	56		2		16	2	0	3	44	0	6	47	50
	54	62	56		14	14	2	3	58	2	9	64	69
	40		42	97	76	40	0	3	98	2	12	109	112
51	52		2		36	2	0	3	100	2	15	114	117
						41 Intervening Cycles Omitted							
	36	22	39		26	26	0	3	869	12	141	1019	1022
	10		13	65	57	10	0	3	879	12	144	1032	1035
80	63		3		47	3	0	3	882	12	147	1038	1041
	60	65	57		44	44	0	3	926	12	150	1085	1088
	16		13	65	57	13	0	3	939	12	153	1101	1104

Alternate 3 (Oven A only) — Replace failed element(s) plus any with 50 or more days' use

Element History									Furnace History									
1			2			3												
R. No.	Life Rmg.	Life Used	R. No.	Life Rmg.	Life Used	R. No.	Life Rmg.	Life Used	Oper. Days	Replace Element(s) 1 2 3	Delay Days	Repair Days	Cum. Optg. Days	Cum. Del. Days	Cum. Rep. Days	Day Down (End of)	Day On (End of)
02	22	0	11	31	0	48	51	0	22	X	0	3	22	0	3	22	25
11	31	0		9	22		29	22	9	X	0	3	31	0	6	34	37
	22	9	17	36	0		20	31	20	X	0	3	51	0	9	57	60
	2	29		16	20	75	61	0	2	X	0	3	53	0	12	62	65
87	66	0		14	22		59	2	14	X	0	3	67	0	15	79	82
									32 Intervening Cycles Omitted								
	27	32	69	59	0		38	31	27	X X	0	5	839	10	136	980	985
65	57	0		32	27	80	63	0	32	X	0	3	871	10	139	1017	1020
	25	32	42	49	0		31	32	25	X X	0	5	896	10	144	1045	1050
65	57	0		24	25	79	63	0	24	X	0	3	920	10	147	1074	1077
	33	24	21	38	0		39	24	33	X X	0	5	953	10	152	1110	1115

Alternate 3 (Oven B only) — Replace failed element(s) plus any with 50 or more days' use

27	42	0	32	44	0	66	58	0	42	X	0	3	42	0	3	42	45
62	56	0		2	42		16	42	2	X	0	3	44	0	6	47	50
	54	2	62	56	0		14	44	14	X	1	3	58	1	9	64	68
	40	16		42	14	97	76	0	40	X X	0	5	98	1	14	108	113
51	52	0	40	48	0		36	40	36	X	0	3	134	1	17	149	152
									33 Intervening Cycles Omitted								
52	53	0	22	39	0		39	24	39	X X	1	5	845	7	138	984	990
	14	39	65	57	0	55	54	0	14	X	0	3	859	7	141	1004	1007
45	50	0		43	14		40	14	40	X X	3	5	899	10	146	1047	1055
	10	40	79	63	0	71	59	0	10	X	0	3	909	10	149	1065	1068
91	69	0		53	10		49	10	49	X X	0	5	958	10	154	1117	1122

How a Table of Random Numbers Looks

LINE	COLUMN 1	2	3	4	5	6	7
1	02	49	05	41	22	27	94
2	11	96	73	64	69	60	[illegible]
3	48	25	68	34	65	49	[illegible]
4	27	24	67	30	80	21	[illegible]
5	32	53	27	72	65	[illegible]	43
6	66	75	79	89	55	[illegible]	37
7	11	26	63	45	45	6	50
8	17	87	23	91	42	45	56
9	62	56	13	03	[illegible]	03	40
10	62	79	63	07	[illegible]	35	49
11	75	51	02	17	[illegible]	04	33
12	87	43	90	[illegible]	91	63	51
13	97	74	[illegible]	26	21	10	74
14	98	81	[illegible]	60	01	21	57
15	51	[illegible]	40	18	52	64	60

Ready with simulation—Neverchip is now ready to play Monte Carlo; that is, perform the simulation. What's needed first is some random sequence of events drawn from the probability distribution of heating-element lives. To generate this sequence we can use a conventional two-digit random-number table (above), which will be our roulette wheel. Just as a roulette wheel, over the long run, tends to come up proportionately at each numbered compartment, so will a long, randomly-generated sequence tend to reproduce the relative frequencies of heating-element lives.

. . . *Alternate 1.* For the simulation of the concurrent histories of Ovens A and B under Alternate 1, see the appropriate table (facing page). The repair time is six days. Number of days of service between repairs for each oven is determined by the smallest of the three random numbers drawn to identify the respective element lives. (In the tables, double failures are identified as "Delay Days," representing the overlap of repair cycles. For our purposes we assume that only one repair operation can proceed at a time. Thus a furnace that comes down for repair while the other is being repaired must stand idle for some number of days until the in-progress repair is completed.)

The simulation begins with the selection of three random numbers to designate element lives in Oven A. These are drawn from the first three lines of Column 1 (left). They are 02, 11, 48. (We could have started anywhere in the table.) We are interested only in the smallest of these, since the oven goes down when the first element burns out. Hence we check the curve and find that 02 (on the cumulative probability axis) corresponds to an element life of 22 days. We enter this 22 days on the first line of the "Operating Days" column and also on the first line of the "Day Down" column. In other words, there's a chance one heating element in Oven A may go out at the end of the 22nd day.

Next we draw another triplet of random numbers (lines 4, 5, and 6 of Column 1) and enter 27, 32, and 66 in the "Random Nos. for Elements" column under Oven B. The smallest of these, 27, corresponds (again from the curve) to element life of 42 days. This figure is entered in the "Operating Days" and "Day Down" columns for Oven B.

Since Oven A goes down after 22 days and Oven B after 42 days, we simulate repair of Oven A by completing the first line of entries. We enter 0 for "Delay Days" (that is, no double failure), 6 in the "Repair Days" column, and appropriate figures for each cumulative column. Since Oven A went down after 22 days' operation, its 6-day repair cycle would be complete at the end of the 28th day. This is the figure we enter in the "Day On" column.

We now draw the next triplet of random numbers and enter them in the second line of the appropriate columns for Oven A. Of 11, 17, and 62, the smallest, 11, represents an element life of 32 days. We enter this on the second line of "Operating Days" column. Adding 32 to 28 ("Day On") gives the next entry in the "Day Down" column, 60.

Now we note Oven B will be down after the 42nd day. So we proceed to simulate its "repair." Its cycle is completed at the end of the 48th day, as noted in the first line of entries for Oven B. We now draw three more random numbers (62, 75, 87) of which the smallest, 62, corresponds to an element life of 56 days. This 56, added to 48, the preceding "Day On" entry, indicates Oven B will go down next at the end of the 104th day.

Since Oven A will next be down after the 60th day, we go back and repair it. This process may be continued for as long as desired. In each case, we repair the oven that comes down first. Occasionally, this will result in consecutive repairs on the same oven.

How double failures and delays arise and are handled can be seen in the 18th cycle for Oven A. Suppose it comes down for repair on the 784th day. Checking the "Day Down" column for Oven B reveals it comes down for repair on the 783rd day and is not back on until the 789th day. Hence Oven A, shut down on the 784th day, would have to wait 5 days (789 − 784) for repair operations to begin. This waiting time is entered as "Delay Days" and is cumulated in the column so designated. Where delays are involved, the "Day On" for the oven is determined by adding to "Day Down" the sum of "Delay Days" and "Repair Days."

At each line for each oven it is possible to check for computational accuracy. In every case the sum of "Day Down," "Delay Days," and "Repair Days" must equal the sum of "Cumulative Operating Days," "Cumulative Delay Days," and "Cumulative Repair Days" to give the entry for "Day On." Thus, for the 18th cycle of Oven A just described, we have:

$$784 + 5 + 6 = 682 + 5 + 108$$
$$795 = 795$$

The rationale here in simulating Alternate 1, of course, is to follow the sequence of events in the oven histories that develops as the result of the random selection of element lives from their probability distribution on the curve. The same reasoning applies to the simulations of oven histories under Alternates 2 and 3.

. . . *Alternate 2.* Again, look at the appropriate table (facing page). Repair time could be three, five, or six days for one, two, or three failed elements, respectively. As before, the over-all plan is to develop, in chronological order, a sequence of operating cycles. As before, Neverchip determines by inspection which oven will come down earlier, and then proceeds with repairs on that oven. In the rare case when both ovens come down on the same day, Neverchip may arbitrarily decide which one must wait. But this decision in no way affects total amount of double-failure time. Structurally

Summary 1—How outputs of simulation look as annual averages

	Repair Cycles			Repair Days			Delays			Delay Days			Oper. Days			Number Elements Replaced		
Alternate	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
1	8.3	7.7	16.0	50.0	44.0	94.0	1.0	0.7	1.7	3.7	3.3	7.0	311.3	317.7	629.0	25.0	22.0	47.0
2	17.3	16.7	34.0	52.7	50.0	102.7	2.7	2.3	5.0	4.7	4.0	8.7	307.7	311.0	618.7	17.7	16.7	34.3
3	13.7	14.0	27.7	49.0	49.7	98.7	1.7	1.7	3.3	3.3	3.3	6.7	312.7	312.0	624.7	18.0	18.0	36.0

Summary 2—How the variable annual cost of each alternate looks

Alternate	Cost of Elements	Cost of Double Failure Days	Variable Annual Cost
1	$39,950	$22,400	$62,350
2	29,155	27,,840	56,995
3	30,600	21,440	52,040

Begins on page 80

the table for Alternate 2 differs from the table for Alternate 1 only in the greater detail required for individual element histories. (To conserve space, only the first five and last five cycles are shown for Alternates 2 and 3.)

. . . *Alternate 3.* The over-all procedure (see the appropriate tables) is similar to that used before. The modifications made are to provide the figures needed to fulfill the conditions under Alternate 3.

THE BEST ALTERNATE

To save space the simulations here have been limited to a three-year span. With the limited experience generated, Neverchip can now answer the questions raised at the beginning of the example. These answers, along with certain additional information, are in Summary 1 (above). Figures are based on the first 1095 days of experience with each oven, so that each entry represents the annual average for the same 3-year interval.

As would be expected, under Alternate 1 the number of repair cycles per year is less than for the others, because all elements are replaced each time. But the number of repair days per oven per year varies relatively little among the three policies. Since Alternate 2 produces the greatest number of repair cycles, it is not surprising that it also produces the greatest number of delays (overlapping repair cycles) as well as the largest total delay days per year. The column reporting number of operating days per year is self-explanatory.

For management to assess relative costs of the alternates, Neverchip needs information on how many elements are replaced under each alternate. As expected, Alternate 1 requires the most replacement elements; Alternate 2, the least. The difference between Alternates 2 and 3 is small.

To answer management's question as to the "best" alternate, Neverchip needs only to determine the annual cost associated with each alternate. To illustrate this in a simple way, four possible costs are considered:

1. Each replacement element costs $850.

2. Each delay day, when both ovens are down, costs $3200, because of disruptions in production and shipping schedules, labor costs for men sent home, and the like.

3. At present Neverchip is able to sell only 600 days' production per year. Thus any of the alternates provides excess capacity. So Neverchip assumes there is no cost of foregone profits when a single oven is down for repair.

4. Since there is an oven maintenance crew on a standby basis at all times, labor costs for repairs are fixed and independent of how many repair cycles are initiated or how many repair days are required per year. This would be an untenable assumption only if repair days per year approached 365. Fact is, each of the three alternates generates much less than that amount of repair days.

Summary 2 shows the variable annual policy costs associated with each alternate under the conditions set down. It is apparent that under the assumptions Neverchip made, Alternate 3 is the most economical. Differing assumptions and other costs, of course, could lead to selection of some other alternate as most economical. The experienced manager will see other ramifications that could enter in. To avoid complexity these have not been introduced here. In practice many additional cost factors would, of necessity, be taken into account.

WAYS TO USE MONTE CARLO

Operations at Lukens are on a job-shop basis. They involve large variations in product mix. The many variables acting upon the steel-making and fabricating process make Monte Carlo a powerful method of attack. The following capsulized versions of some of the problems Lukens has studied by means of Monte Carlo show its flexibility:

Optimum provision of steel plate—In the steel industry the job of "provider" is to determine the size

of the ingot or slab which, when rolled out in plate form, will produce the rectangular pattern ordered by the customer without incurring too much scrap. The vagaries of the rolling and shearing process are such that the provider must add certain allowances to the pattern size to insure enough good metal to meet the order. Tight provision tends to produce a greater reject rate through failure to "make the pattern." Loose provision tends to insure making the pattern but generates a large amount of excess material, which must be scrapped.

The objective in this problem was to determine the allowances that should be added so as to balance, over the long run, costs due to dimensional rejections against cost of excess scrap generation.

We found that the rolling process could be characterized by four probability distributions: (1) the roller's performance on meeting ordered gage and (2) ordered width; (3) deviations from expected lengths and (4) from expected widths due to process factors. We tested alternate providing allowances with Monte Carlo and were able to forecast what would happen on dimensional rejections under the alternates selected. Applying cost factors, we then were able to select those allowances that would result in lowest total costs.

Warehousing of products—Although a certain product of ours had historically been made on a custom basis, the suggestion was advanced that this product could be produced in large plates (thus improving yield), which could be later cut to the customer's order. The advantages of producing to stock, in addition to giving a higher initial yield, would be quicker order delivery and smoother scheduling.

We used Monte Carlo in one phase of this problem to determine the cutting losses that might be incurred due to a varied product mix. Using past distributions of demand we generated random sequences of orders by Monte Carlo and introduced decision rules for this simulation to correspond with practice. The results indicated that, as far as yield factor was concerned, the higher initial yield in producing large plates was more than wiped out by losses incurred from cutting these plates to customer order.

Effect of repair time on open-hearth furnaces—In our open-hearth operation each furnace has to be rebuilt every 100 days or so on the average. During this rebuild time the furnace is inoperable, thus reducing output of the entire group. Further, if two furnaces require rebuilding at the same time, one must wait until a certain portion of the work is completed on the first furnace.

Monte Carlo enabled us to determine the effect on open-hearth output and the bunching of "arrivals" for rebuild under alternate rebuild schedules. The results of this study showed that a reduction in rebuild time (by increasing crew size) would increase availability and reduce the bunching of furnace "arrivals" and the resulting waiting time.

Optimum manpower in a service facility—One of Lukens' departments is a service group whose function is to record production data in conjunction with the company's incentive plans. Although the members of this service group are salaried employees, we pay overtime for hours worked in excess of 40 per week. The workload for this group was variable from week to week and time was lost through absenteeism. The objective was to determine the optimum manpower level that would balance overtime costs with excess manning costs, although most of this latter time is used for training.

We used Monte Carlo to generate a sequence of weekly loads and manhours lost through absenteeism. The results of this approach matched very well with a mathematical model we also used to describe the system.

Man-machine analysis with variable set-up time—In Lukens' machine shops two machines were being used to perform a routine operation. Somebody asked why we didn't have one operator run both machines. The problem was to determine how much machine idle time, and hence lost production, would be incurred if we made this adjustment. The problem did not lend itself to the standard waiting-line theory. Probability distributions of set-up, take-down, and machine-cycle interruption time per work cycle were available from time-study data.

We used Monte Carlo to simulate the performance of one man operating two machines and then tabulated the resulting time lost through machine wait on operator.

Results indicated that this waiting time would be small enough to justify the two-machine, one-operator combination.

MORE WAYS TO PLAY

The wide versatility of Monte Carlo suggests other broad problem areas that can be studied with this method. For example:

Waiting-line and congestion problems—Some problems are too involved for easy mathematical analysis. For these Monte Carlo is a flexible approach. For instance:

1. What would be the effect on subsequent operations of a speed-up of some branch of the materials-handling system (e.g., a conveyor)?
2. How many cranes should be used in a work area where demand for crane service is intermittent?
3. What is the proper staffing level for tool cribs, maintenance labor, and the like, in which demand for service is variable?

Production scheduling—The best of production schedules is subject to delays of various types to work in process. Monte Carlo can answer questions like these:

1. What is the best sequence of orders to minimize time in process through a job-shop operation?
2. How much excess capacity to handle peak loads should be built into a production process?
3. How much buffer space for storage should be provided between production operations?

Repair and preventive maintenance—The scheduling of repair and preventive maintenance can be studied by simulation to answer these questions:

1. What is the optimum period between maintenance checks for selected classifications of production equipment?
2. How many spare parts should be stocked as insurance items?
3. How should maintenance crews be assigned by plant area?

Line balancing in capacity additions—In considering expansion or new methods, the interdependency of operations suggests that Monte Carlo can be used to balance input and output capacities when they are affected in any way by product-mix variations.

Most Plant Operating Managers Are... Happy... Friendly...

WHO SAYS SO? Life Extension Foundation, research arm of Life Extension Examiners, longtime (since 1913) health maintenance service for executives. It has just analyzed 756 plant operating managers exclusively for FACTORY. Conclusion: Plant operating managers don't differ much from other managers.

To see where you stand, read on.

Happy and satisfied. That's the way typical plant operating managers feel about their work. Nearly all of them (83%) like their jobs. Almost as many accept homework with reasonable willingness. Only a few (22%) feel they're working too hard. The entertaining that goes with many a manager's job is enjoyable for 3 out of 4 of them.

Friendly relations mark the plant operating man. Only 1 in 5 works with people he'd like to drop off a bridge. With their associates and superiors, 72% of them find a climate in which they can express themselves without fear. Almost all (94%) feel that their boss is not a glory hog—that he lets them take credit for what they do.

But Some Are Tension Victims...

The research that produced the welcome news above also tells the details of the tension victim's sad story. Men who reported that they feel they are under constant tension were compared (in the survey) with men who reported occasional stress or none. Here's how tense managers compare with relaxed managers:

1. Boredom with the job is 355% higher for tense managers.

2. Suspicion of not getting full credit for their work is 207% higher.

3. Homework is not a very significant factor. Incidence of frequent homework is only 9% greater among tension victims. But 32% more of them dislike it, as opposed to the average manager, who tends to accept it gracefully.

4. Health habits are poorer. More of the tension victims eat on the fly. They get less rest, have fewer recreational interests. And many of them use sleep-inducing and tranquilizing drugs.

5. Fear of self-expression is 633% higher among managers who are tense.

6. Dislike of some work associate is 99% higher for the tense group.

7. Youth enters into the picture. The highest incidence of tension (16%) is among the 30-35 age group. And the incidence of tension gradually tapers to half that for men who are 60 or over.

8. Work schedules for tense and non-tense men are somewhat different. Tense men start and quit later, but work just as long.

9. Occupation seems to be related to tension—but perhaps only in the type of men who naturally find employment in this line of work. If the job is a responsible one, you'd expect research and legal work to be low on tension. But research is low, legal work isn't. You'd expect advertising and sales promotion to be high-tension jobs. Advertising is, sales promotion is not.

10. Progress in their jobs is a source of dissatisfaction for 155% more tense than non-tense managers.

11. Travel—or distaste for it—is a problem for 45% more of the tension victims.

12. Retirement at age 55 is a goal for 60% more of the tense men.

13. Job insecurity—fear of failure and ultimate discharge—is 174% higher among the tense.

14. Worry is the curse of the tense man. And his worries are unreal. For example, 83% more worry about money. But the survey results show that the tension victims, as a group, make slightly more

Well-Mated... Tranquil... Temperate

The little woman is encouraging, helpful, enjoys business entertaining, accepts her spouse's homework. But there's a difference between plant operating managers and other managers: Asked about their wife's attitude toward their career, 82% of all managers say she's "encouraging, helpful"; only 77% of plant operating managers say so.

Tranquil is the word for most. They're free of anxiety, tension. They challenge the popular picture of an ulcer-ridden, nervous worrier. Usually they're not worried about their health, their personal finances, homes, or jobs. The conclusion: Plant management men are no more tense than machinists, maintenance electricians, or janitors.

Temperate living marks most operating managers. Some 86% of them fall asleep easily at night, have weekends free. Most sleep seven hours or more. Few have special diets. Pre-lunch cocktails are far rarer than pre-dinner drinks. Over half of them have a hobby. Over 75% take a summer vacation. Fewer than 5% feel they need tranquilizers.

Maybe You. Here Are 17 Symptoms

money than the average of all the managers studied. Personal health is a source of worry for 133% more tense managers, but only 16% more indicate, on the same survey, a health deficiency. Seven out of 10 men under constant tension report some significant personal problem. Here the logical question is: Do they really have a special personal problem they wouldn't have if they weren't tense and worried in the first place? Other evidence indicates no.

15. Entertainment chores are a source of irritation to a disproportionate number of tense men. Fifty-nine per cent more complained.

16. Job tenure is a factor. Men who have been in their present job less than a year report least tension. One explanation: Men who are in their first year on a job often are capable, well-adjusted managers on the way up. They're good, they know it, and they got their new job less than a year ago—partly because they weren't tense and worried in their old jobs. Another explanation: They are so busy in their new jobs they haven't time to worry.

17. Company tenure is another factor. And in the opposite direction from what you might expect. Only 7% of the men with their company less than one year report constant tension. Men who have been with their company one to five years report constant tension in 12% of the cases. The figure steps up to 14% for managers who have more than five years of service. Chances are the managers who are new to their company are hot shots, hired away from a company that wasn't giving them the challenge they deserved. The chicken-or-the-egg riddle applies to the longer-tenure managers. Are the five-year service men tense and anxious because they've stopped progressing? Or have they stopped progressing because they're tense and anxious.

SO WHAT?

What conclusions does the Life Extension Foundation draw from this exclusive study? Just these:

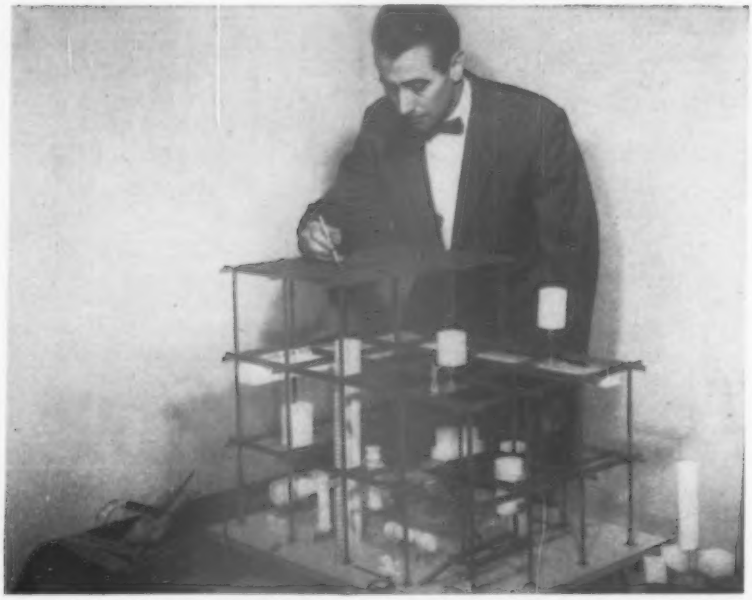
. . . *Tension is seldom if ever caused by the job.*

. . . *Tension victims tip their hand,* show their symptoms in their response to the job, their associates, their personal lives.

. . . *Tension is clearly identified* with the personality of the individual manager rather than with the outer forces of his environment.

FACTORY EQUIPMENT NEWS

For more about these items, circle numbers on Reader Service Card next to back cover.



NOW YOU CAN BUILD SKY-HIGH 3-D PLANT MODELS WITH . . .

"Do-It-Yourself" Model Kits

Engineering scale components of piping and structural forms enable everyone concerned to see what's going on—thus expedite design and construction. About 200 piping components are available—including extruded pipe, fittings, and valves in 9 sizes and 4 colors; and molded styrofoam vessels, exchangers, and pumps. Structural members consist of molded cross arms, beams, and footers; H-columns; and miscellaneous molded stairs, ladders, platforms, and other related parts.

Industrial Models, Inc. (Circle 101, Reader Service Card).

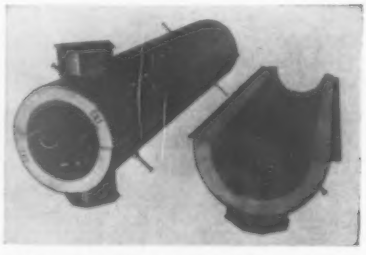
102—Solution Tank "Replenisher" automatically feeds and mixes dry chemicals and water to restore tank level. This simple, low-cost unit adapts to any equipment with solution tanks in process and chemical industries. *Cincinnati Cleaning & Finishing Machinery Co.*

103—Instrument Clock fits all makes and types of recording instruments requiring chart records from 1-hour to 30-day periods. Air-or gas-powered, it uses 5 cfh. at normal operating pressure of 5 psi. It is explosion-proof and corrosion-proof. *American Meter Co.*

104—Screwdriver/Nut Runner automatically starts when tool engages screw and shuts off instantly when the screw is tightened to torque specifications. Operates only during actual rundown; uses less air. Nonfriction clutch eliminates slippage. *Cleco Air Tools.*

105—Pneumatic-Tire Lift Trucks of 6000-, 7000-, and 8000-lb. capacities feature 6-cyl., 70-hp. engine; lifting speed to 66 fpm.; operating speed to 16 mph. Single-drive wheels on two heavier models; dual-range, hydraulically shifted transmission is optional. *Hyster Co.*

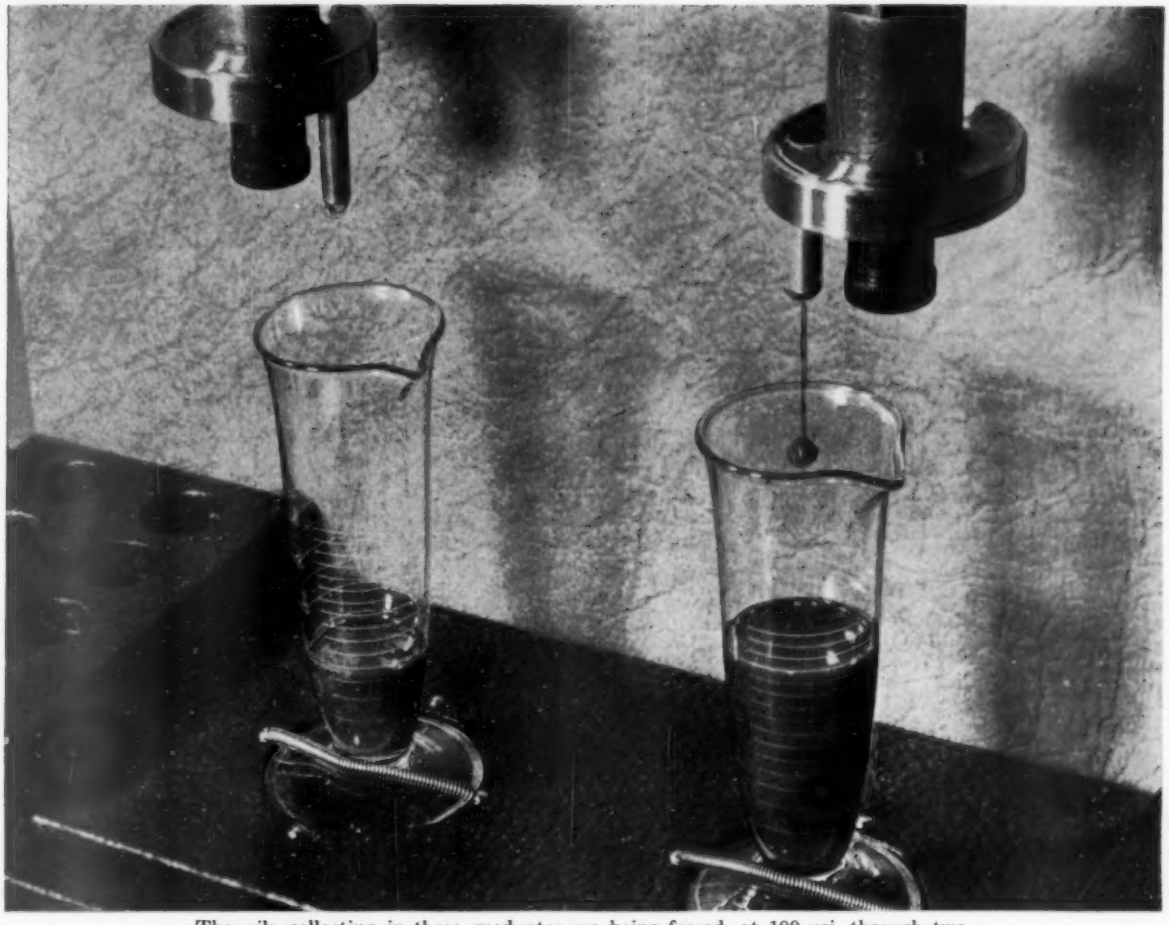
106—Outdoor Walk-In Substation for metal-clad 4160-v. or 13.8-kv. switchgear is easily erected, provides generous space for withdrawing breakers and for testing meters and relays in a protected area. Permits single or face-to-face line-ups. *I-T-E Circuit Breaker Co.*



107—Pipe-Heating Unit replaces heat lost during transfer of liquids through pipes up to 3-in.-dia. Unit consists of a steel-sheathed tubular heater rated 600 watts, 120 or 240 v., mounted on an aluminized reflector. Thermostat range is to 650 F. *General Electric Co.*

108—Adjustable Storage Racks of steel may be fitted with shelves 54-, 90-, or 108-in. long to fit specific storage requirements. Shelves, with 5000-lb. capacity each, lock into vertical panel slots to provide openings for stock of varying dimensions. *Palmer-Shile Co.*

Turn the page



The oils collecting in these graduates are being forced, at 100 psi, through two sintered bronze bearings. Although each oil has the same viscosity, the Suntac on the left is leaking *only one quarter as much as* the straight oil on the right.

Desk-top demonstration proves that SUNTAC HYDRAULIC OILS can cut your oil losses . . . up to 75%

Suntac® oils are competitive in price, competitive in quality, *and unique in their ability to reduce oil leakage without costly shutdowns.*

Suntac oils are high-quality, exceptionally stable mineral oils especially compounded to reduce leakage. Experience proves that they give longer pump and seal life with higher overall operating efficiency.

See for yourself how a Suntac oil can cut your oil costs. A simple desk-top demonstration will show you how.

Ask your Sun man to show you how others have reduced oil consumption, or write to Dept. F-2.

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO®

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In Canada: Sun Oil Company Limited, Toronto and Montreal

For more facts Circle 494 on Reader Service Card

For more about these items, circle numbers on Reader Service Card next to back cover.

CONTRASTING-COLOR LETTER AND NUMBER-TAPE . . .

Stick-Ons Change Chart Quickly

Execu-flex, a 28x40-in. chart with permanent grid, graphically illustrates a company's progress or status with easily applied adhesive markers. Made of walnut on black lacquer base, chart is an attractive permanent wall fixture. Changes and revisions may be made rapidly to maintain an up-to-date visual picture of progress. Chart comes in three types, in kit form, for sales or business trends, comparative graphs, or company organizational layouts. Each kit contains illustrated instructions, letters, numbers, tapes, and papers in contrasting colors. Materials are pressure-sensitive and easily removed, yet will adhere as long as desired. The permanent grid guides you in aligning boxes for organization charts, or plotting figures for graphs. Special sizes and finishes to order.

Chartmakers, Inc. (Circle 109)

Lightweight Radii-Finishing Hand Tool

Outside radii and convex surfaces can be simply and quickly finished with an abrasive-belt hand tool accessory weighing about 1 lb., less motor. For use with any air motor, produces about 4000 sfm. at 17,000 rpm. Applications include tool and die work; tool and fixture construction; spot metal finishing; deburring and de-edging; machine construction and maintenance; polishing on lathes and grinders. *Peterson Tool & Mfg. Corp.* (Circle 110).

111—"Shelter-Clad" Switchgear provides sturdy, weather-protected housing for on-the-spot maintenance, with a 75-in.-wide aisle. Current transformers are located behind removable metal barrier, in front of automatic primary disconnect shutters. *Allis-Chalmers Mfg. Co.*

112—Reel Positioner handles wire, sheet-metal coils or hollow-centered, cylindrical shapes simply and accurately. Unit lifts reels up to 500 lb. by pedal-operated hydraulic mechanism. Mechanical lock holds reel raised for indefinite periods. *American Pulley Co.*

113—Tape Dispenser delivers precut labels, masks, or special die-cut shapes made of any pressure-sensitive tape for fast production line application. Roll holds labels of different sizes and shapes. Choice of foot or micro-switch operation. *W. H. Brady Co.*

114—Mechanical Floor Mat automatically wipes shoes clean when stepped on, cuts floor maintenance in plant vestibules and problem "white" rooms. Bank of motor-driven nylon brushes is mounted beneath grill; dirt falls into catch-pan below. *Progressive Engineering Co.*

115—Reflective Markers are stick-on, eliminate painting and stenciling for ready identification of parts, areas, and equipment. Letter and numeral markers are more reflective than white or yellow stenciled paint; visible day or night. *Western Lithograph Co.*

Turn the page

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*

Careful addition of sulfur to melt guarantees typical sulfide distribution, as shown in photomicrograph of longitudinal specimen of EZ MACHINING tool steel.

Sulfur addition to melt held to narrow range in Allegheny Ludlum's EZ MACHINING GRADES

Uniform, finely-distributed sulfides mean uniform machining, uniform high finish, uniform long tool life order after order

Adding sulfur, actually an impurity, to a tool steel melt to make it free-machining must be done with care and precision. That's why Allegheny Ludlum maintains an extremely close average range in adding sulfur to its EZ MACHINING grades. But mere range, however narrow, is not enough. A-L has developed special techniques in adding sulfur and nucleating agents to produce the uniform, finely-distributed sulfides that characterize good free-machining tool steels.

A-L's extra care means you can standardize your machining operations from piece to piece and order to order. This reproducibility is reflected in uniform *machining;* uniform *high finish;* uniform *long tool life.*

For example, in the production of hobs these machining properties in Allegheny Ludlum's EZ MACHINING steels minimize the costly "backing off" operation for back clearance of multiple teeth, eliminating complicated extra heat treatment. Lower residual stresses are set up, because the steel has a lower resistance to the cutting action. Naturally, hobbing is only one of the situations where these free-machining characteristics can benefit you.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Building, Pittsburgh 22, Pa. Address Dept. F-14

WSW-7259

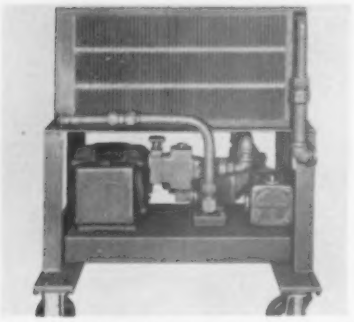
ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

For more facts Circle 495 on Reader Service Card

For more about these items, circle numbers on Reader Service Card next to back cover.



116—Hydraulic Filter System on wheels permits cleaning hydraulic reservoirs without interrupting operation; "tell-tale" filter shows operator when to clean out collected dirt. Attached hoses are inserted in reservoir openings to draw fluid out through filter. *Rosaen Co.*

117—Outdoor Switchboard Enclosure with an outside door at each end is fully waterproofed to protect operators and equipment. Basic unit can be enlarged by removing end trim containing door, inserting added unit, then replacing end trim. *Westinghouse Electric Corp.*

118—Pillow Block, permanently lubricated with greased, factory-sealed ball bearing, does away with further lubricating for life of unit. Comes in shaft sizes up to $1\frac{15}{16}$ in.; interchangeable with most other types of pillow-block installations. *Marlin-Rockwell Corp.*

119—Power Sweeper, self-propelled and guided by operator, cleans over 40,000 sq. ft. per hour. Ideal for narrow areas; turns completely around in its own width. Dust control system eliminates dust bag. Fingertip controls provide safe, simple operation. *Wayne Mfg. Co.*

120—Press Automation Unit converts single-action press into transfer feed press; moves from press to press for job-lot operations. It will feed two or more presses in line; automatically feeds materials in and out of press die areas. *Press Automation Systems, Inc.*

121—All-Electric Entrance package unit—complete with door, frame, and operating mechanism—offers completely automatic operation for use anywhere in plant. Operating mechanism is concealed in transom; narrow-line framing gives unit attractive appearance. *Kawneer Co.*

122—Lightweight Air Hammer attaches "push-on" fasteners in one-third the time needed for hand fastening, and with less operator fatigue; says maker. Comes with pistol grip or straight handle; weighs 20 oz., uses 6.5 cfm. at 90 psi. *Superior Pneumatic & Mfg., Inc.*

123—Swivel Joint with interchangeable packing provides wide range service, from chemicals to steam and hot gas; packing seals can be replaced without removing joint from line. Maximum temperature is 600 F., pressure 1000 psi.; $\frac{3}{8}$- to 4-in. sizes. *Chiksan Co.*

124—Fuseless Starter for high-voltage motor drives has capacity of 100,000 kva. at 2400 v., 150,000 kva. at 4800 v. Phase barrier and arc-chutes draw out horizontally, making front and rear contact tips accessible for easy maintenance. *Electric Controller & Mfg. Co.*

Dome Built in a Day

Erect a weatherproof dome structure in just 20 man-hours, by simply bolting together 38 factory-assembled "space frames." As shown, dome takes shape as lightweight plastic-faced plywood frames are set either on concrete slab or ground (insulating, painting, and finishing takes another day). With no interior columns or beams, you use all the space you buy (nearly 500 sq. ft. of floor space with this 13-ft.-peak, 26-ft.-dia. model).

Pease Woodwork Co. (Circle 125.)

Turn the page

nd STEELFLEX are Registered Trademarks

Cut disconnect-reconnect time by as much as 50%

The FALK Spacer Coupling is specially designed for quick installation or removal *without disturbing the driving or driven unit.* This feature can save you up to 50% in disconnect-reconnect time when critical equipment—a process pump, for example—needs repair or replacement.

Here's another saving: with the FALK Spacer Coupling, you can quickly realign shafts *without the usual loss of operating temperature!*

And still another: you can remove or reinstall the FALK Spacer as a unit *without draining the lubricant.*

Because of its exclusive grid-groove Steelflex design, the FALK Spacer can accommodate residual misalignment—parallel, angular, or (most important) *both.* Also, it provides torsional resiliency that cushions shock and vibration. Thus it saves wear-and-tear on your connected equipment.

To prove these claims and enjoy these savings, install a FALK Spacer on one application—and see for yourself. Consult your FALK Representative or Authorized Distributor.

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS

Representatives and Distributors in many principal cities.

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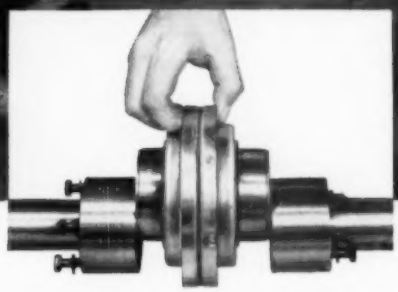
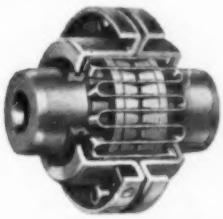


EASY AND QUICK TO INSTALL, DISCONNECT OR RECONNECT

First, mount shaft hubs to allow proper distance between hubs; then, align driving and driven units.

Second, compress Spacer to fit space between hubs and tighten cap screws to pull spacer hubs into the registered fit.

To disconnect, reverse the second step. No draining of lubricant necessary.



The heart of the FALK Spacer ...the basic Type F Steelflex

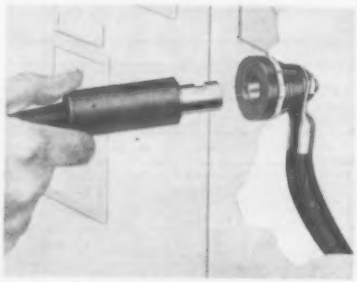
Write for Service Manual 4838

FALK

...a good name in industry

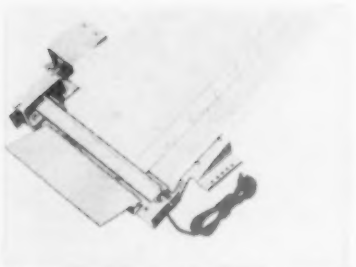
For more about these items, circle numbers on Reader Service Card next to back cover.

126—Metal Tester-Sorter, using a standard part as control, quickly unscrambles mixed or incorrectly processed metal parts. Sorts raw or finished parts according to hardness, structure, and so on. Works by hand, or automatically with companion unit. *J. W. Dice Co.*



127—Plastic Panel Receptacle, for making fast, positive power connections without tools, can be mounted, without further insulation, on switchgear, junction boxes, etc. Hi-impact plastic insulation prevents shorts. Uses cable sizes # 16 to 4/0. *Empire Products, Inc.*

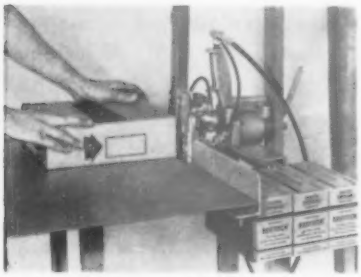
128—Cleaning Tray with 120-sq.-in. magnetic surface area separates ferrous contaminants from metalworking coolants. Unit measures 15x21 in., has capacity of 15 gpm. of water-soluble oil or chemical-type coolant. Can be quickly mounted over coolant tank. *The Kebby Co.*



129—Automatic Dispenser for packaged goods or parts may be used with automatic warehouse handling equipment or on production line. Solenoid-operated unit, automatically or manually actuated, operates on 110-volt a-c; costs about $33. *Industrial Electronic Engineers, Inc.*

130—Air Brush, for small parts finishing and touch-up, produces pencil-thin line, broad shading, or stipple effect. Available in two models for use with medium to light-heavy lacquers, enamels, paints. Weighs 2 oz., uses ¾ cfm. air at 25- to 30-lb. pressure. *Binks Mfg. Co.*

131—Strapping Machine uses ⅜- to ½-in. flat steel strapping to bind corrugated or wooden cases up to 17 ties/min.; handles 7500 ties without reloading. Automatically adjusts tension for packages 4 in. high x 8 in. wide to 22x20 or 15x26 in. *A. J. Gerrard & Co.*



132—"Sidestrike" Stapler seals partial or full overlap, telescope, slotted containers, and five-panel folders from outside. Carton pushed against automatic trip bar sets air-operated machine in motion. Vertical or horizontal stapling by rotating head. *Bostitch.*

133—Man-Size Dragline Shovel, in various sizes, for fast handling, unloading of bulk material. Operator works shovel handle controls by on-off pushbutton switch; using separate control cable and take-up reel. Low-hp. motor; magnetic clutch. *Munson Mill Machinery Co.*

134—Hydraulic Lift Table with turntable top loads long, heavy, bulky products on rack placed on table. Table shown is 54x79 in. with lift up to 42 in.; available in longer models with greater lifting distances. Capacities to 30,000 lb. *West Bend Equipment Corp.*

Turn the page

For more facts Circle 497 on Reader Service Card →

Good bet: You're paying for lubricants you don't need

Does this case sound familiar to you?

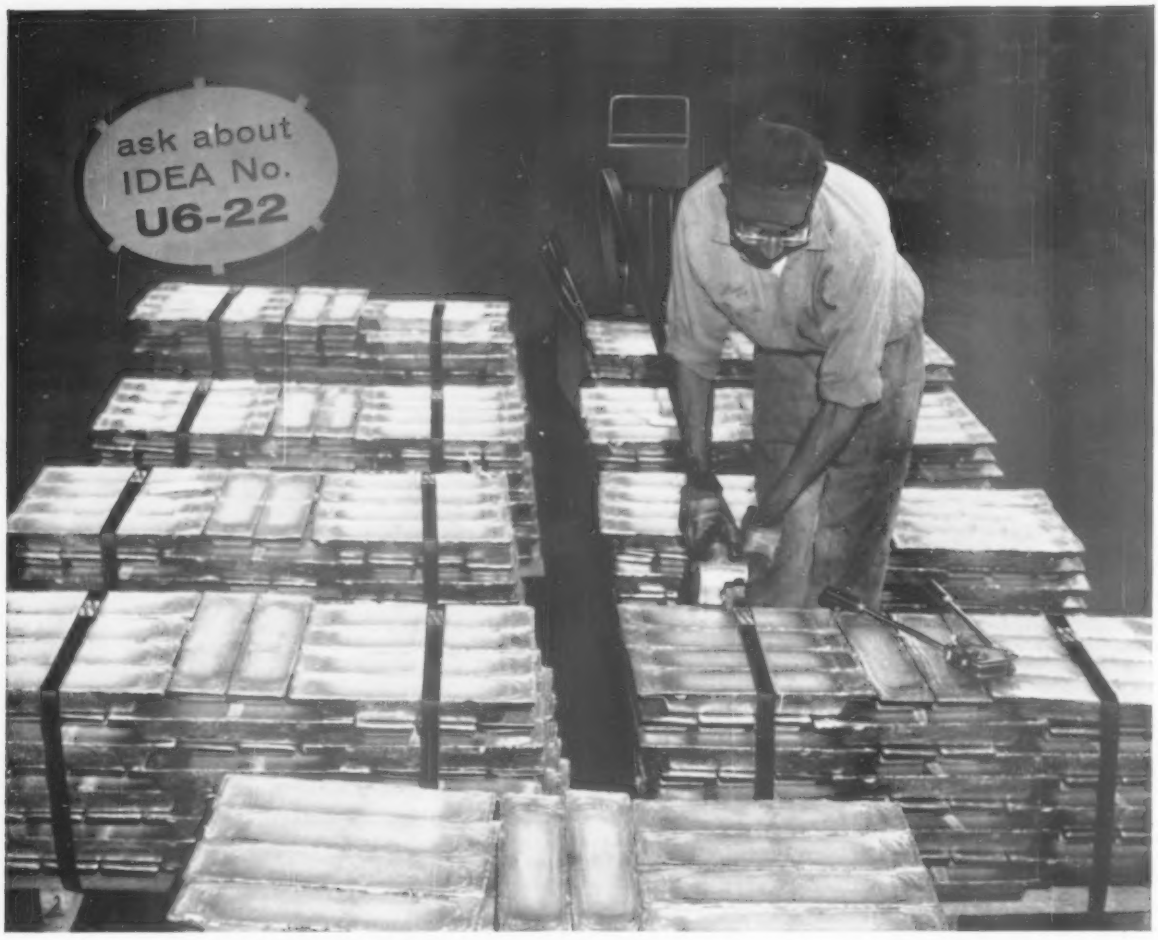
A midwest firm was buying lubricants on the recommendation of every department head, foreman or even operator. Inventory—often duplicated—was scattered all over the plant, yet shortages in one spot were never related to overstocks in another. The result: costly overstocking, extra handling, increased dangers of misapplication.

Management then instituted an Organized Lubrication Plan. Now they use 20 lubes instead of 97, have cut their purchase orders from 300 to 12 per year. Direct savings are estimated at thousands of dollars annually.

Can Organized Lubrication save money in your plant? Contact your local Texaco Engineer or write for "Management Practices that Control Costs via Organized Lubrication." The Texas Company, 135 East 42nd Street, New York 17, N. Y., Dept. F-80.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

TUNE IN... Metropolitan Opera
Radio BROADCASTS
every Saturday afternoon



Work with your AIM* . . . Federated Metals does . . .

Steel strapping cuts ingot loading time in half

FEDERATED METALS Division of American Smelting and Refining Company, Whiting, Ind., was looking for ways to speed handling and unloading of non-ferrous alloys. Their Acme Idea Man suggested a method using heavy-duty Acme Steel Strapping (Idea No. U6-22).

Acme Idea Man Andy Bassi assists Federated Metals and many other companies with their packaging and materials handling problems.

Now ingots are strapped to skids and these units are loaded into box cars and trucks with lift trucks. Formerly, the ingots were loaded loose on skids brought to the cars and stacked by hand. The new method cuts loading time by 50%, and customers report unloading costs are reduced by as much as 75%!

Unitizing ingots enables Federated Metals to double and triple storage capacity, too, because the units can be stacked for maximum utility of warehouse space.

***Work with your Acme Idea Man** to improve your materials handling from a time and money-saving standpoint, as well as for increased product protection. Write Dept. FAU-29, **Acme Steel Products Division** Acme Steel Company, Chicago 27, Illinois. In Canada, Acme Steel Company of Canada, Ltd., 743 Warden Ave., Toronto 13, Ontario.

ACME STEEL STEEL STRAPPING

For more facts circle 498 on Reader Service Card

LOOK *for safeguards in industrial handcleaners*

SOOTHING LANOLIN

A rich lanolin content in West LAN-O-KLEEN Handcleaner combats the depletion of natural skin oils during washing. It has a retarding effect on the defatting action of soap. As determined by laboratory tests. And confirmed by years of industrial experience.

The lanolin in LAN-O-KLEEN is not milled into the soap by conventional methods. It is impregnated into a corn meal base by an exclusive process. In this way a higher content is achieved. But more important, the emollient is "free" lanolin. By being "free" its soothing and softening action is more positive and beneficial.

LAN-O-KLEEN offers still further advantages. Its corn meal base gently soaks up potential skin irritants with a soft, sponge-like action. A balanced combination of soaps provides high sudsing without excessive hand rubbing. Each pound bulks up to 50% more than most powdered soaps —and lowers costs with proportionately more washings.

FREE TRIAL OFFER. We'd be glad to supply a dispenser and five pounds of LAN-O-KLEEN for free trial. Or if you prefer, we'll send a sample for evaluation. Just call your nearby West office. Or mail the coupon below to our Long Island City headquarters, Dept. 14.

☐ Supply trial dispenser and 5 lbs. of LAN-O-KLEEN.

☐ Send a packet of LAN-O-KLEEN for evaluation.

Name _____

Position _____

PROGRAMS AND SPECIALTIES
FOR PROTECTIVE SANITATION
AND PREVENTIVE MAINTENANCE

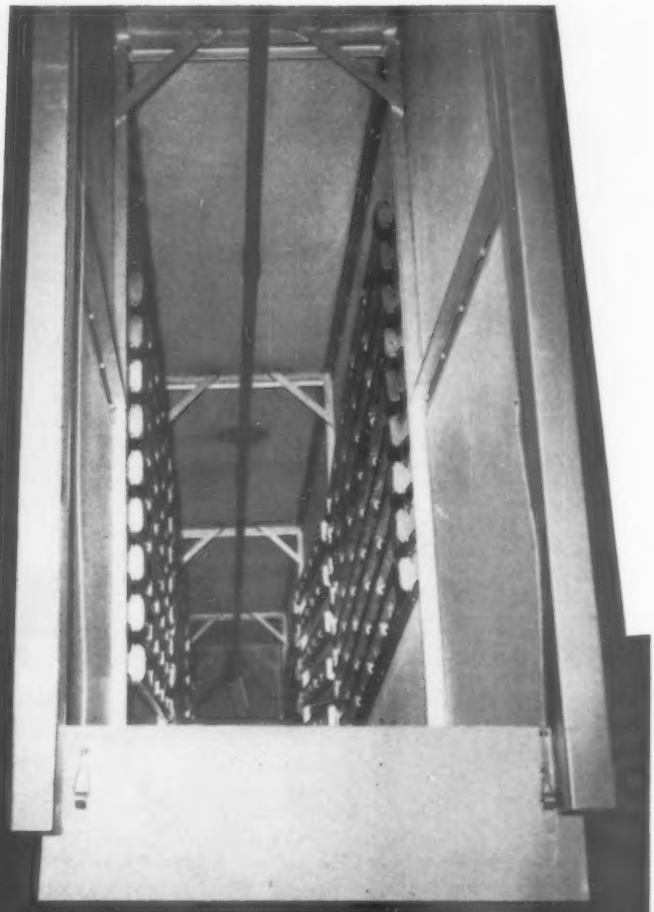
WEST CHEMICAL PRODUCTS INC.

WEST DISINFECTING DIVISION

WEST CHEMICAL PRODUCTS INC.
42-16 West Street, Long Island City 1, New York
Branches in principal cities
CANADA: 5621-23 Casgrain Avenue, Montreal

For more facts Circle 499 on Reader Service Card

From a cold start, this oven reaches operating temperatures (to 425°F) in about ten minutes. Conveyor speed is adjustable from 2 to 6 feet a minute, and baking time from 5 to 16 minutes.



If heat can cure your "growing pains"

Your Chromalox Man has the **ANSWER**

When increased sales or new products cause production line heating problems, call in your Chromalox Man for the quick, economical, electrical answer. By installing the oven shown above, a New England metalworking plant recently solved several problems arising from an expanded line of products.

Previously, some of the company's products had been sent out for painting and baking, while the remainder were painted and air dried at the plant. When a new, larger item was added to the product line, neither the company nor the outside firm was equipped to handle the paint baking. After considering the outside charges and delays which had caused them to lose some rush orders, it was decided to install their own oven. They then called in the Chromalox Man for a quick, economical, electrical answer.* Now, all painting and baking is done at home in a 32-foot electric radiant oven, using 42 Chromalox Type RAD Far-Infrared Heaters.

Chromalox Input Controllers accurately regulate baking temperatures for each of three heat zones. With these cycling devices, capacity can be accurately controlled from 4 to 100% of heater capacity. In addition, top or bottom sections of each zone can be shut off to handle varying work sizes.

Chances are your Chromalox Man can help you find answers to *your* production line heating problems.

**For a detailed account of this actual case history, write for Application Report 403.*

4881

CHROMALOX
Electric Heat
INDUSTRIAL • COMMERCIAL • RESIDENTIAL
EDWIN L. WIEGAND COMPANY
7518 Thomas Boulevard • Pittsburgh 8, Pa.

Call Chromalox

for the man with the ELECTRICAL ANSWERS to your heating problems

ATLANTA 9, GA.
Applebee-Church, Inc.
1389 Peachtree St., N.E.
Trinity 5-7244

BALA-CYNWYD, PA.
J. V. Calhoun Company
349 Montgomery Ave.
Mohawk 4-6113
Greenwood 3-4477

BALTIMORE 18, MD.
Paul V. Renoff Company
333 East 25th St.
Hopkins 7-3280

BINGHAMTON, N. Y.
R. P. Smith Co., Inc.
94 Henry St.
Phone 4-7703

BLOOMFIELD, N. J.
R. L. Faber & Assoc., Inc.
1246 Broad St.
Edison 8-6900
New York: Worth 4-2990

BOSTON 11, MASS.
Leo C. Pelkus & Co., Inc.
683 Atlantic Ave.
Liberty 2-1941

BUFFALO 2, N. Y.
Niagara Electric Sales Co.
505 Delaware Ave.
Summer 4000

CHARLOTTE 2, N. C.
Ranson, Wallace & Co.
116½ E. Fourth St.
Edison 4-4244
Franklin 5-1044

CHATTANOOGA 1, TENN.
H. R. Miles & Associates
P. O. Box 172
Amherst 5-3862

CHICAGO 5, ILL.
Fred I. Tourtelot Company
407 S. Dearborn St.
Harrison 7-5464

CINCINNATI 8, OHIO
The Smysor Company
1046 Delta Ave.
Trinity 1-0605

CLEARWATER, FLA.
J. J. Galleher
617-A Cleveland St.
P. O. Box 1376
Phone 3-7706

CLEVELAND 13, OHIO
Anderson-Bolds, Inc.
2012 W. 25th St.
Prospect 1-7112

DALLAS 26, TEX.
L. R. Ward Company
3009 Canton St.
Riverside 1-9004

DAVENPORT, IOWA
Volco Company
215 Kahl Building
Phone: 6-5233

DENVER 2, COLO.
E. & M. Equipment Co.
2415 Fifteenth St.
Glendale 5-3651
Genesee 3-0821

DES MOINES 14, IOWA
Midwest Equipment Co.
of Iowa
842 Fifth Ave.
Cherry 3-1203

DETROIT 38, MICH.
Carman Adams, Inc.
15760 James Couzens Hy.
University 3-9100

HOUSTON 3, TEX.
L. R. Ward Company
3605 Polk Ave.
Capitol 5-0356

INDIANAPOLIS 8, IND.
Couchman-Conant, Inc.
1400 N. Illinois St.
Station A, P.O. Box 88023
Melrose 5-5313

KANSAS CITY 6, MO.
Fraser D. Moore Co.
106 E. 14th St.
Victor 2-3306

LOS ANGELES 15, CAL.
Montgomery Brothers
1053 S. Olive St.
Richmond 7-9401

MIDDLETOWN, CONN.
Dittman and Greer, Inc.
33 Pleasant St.
Diamond 6-9606

MILWAUKEE 3, WIS.
Gordon Hatch Co., Inc.
531 W. Wisconsin Ave.
Broadway 1-3021

MINNEAPOLIS 4, MINN.
Volco Company
831 S. Sixth St.
Federal 6-3373

NASHVILLE 4, TENN.
H. R. Miles and Associates
2500-B Franklin Rd.
Cypress 2-7016

NEW YORK CITY, N. Y.
See "Bloomfield, N. J."

OMAHA 2, NEB.
Midwest Equipment Co.
1614 Izard St.
Atlantic 7600

PHILADELPHIA, PA.
See "Bala-Cynwyd, Pa."

PITTSBURGH 6, PA.
Woessner-McKnight Co.
1310 Highland Building
115 S. Highland Ave.
Emerson 1-2900

PORTLAND 9, ORE.
Montgomery Brothers
1632 N.W. Johnson St.
Capitol 3-4197

RICHMOND 26, VA.
O. M. Thompson
Westhampton Station
P. O. Box 8762
Atlantic 8-8758

ROCHESTER 4, N. Y.
Niagara Electric Sales Co.
133 Clinton Ave. S.
Hamilton 6-2070

ST. LOUIS 1, MO.
C. B. Fall Company
317 N. 11th St.
Suite 1001
Chestnut 1-2433

SAN FRANCISCO 3, CALIF.
Montgomery Brothers
1122 Howard St.
Underhill 1-3527

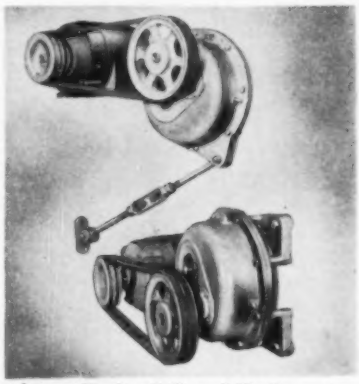
SEATTLE 4, WASH.
Montgomery Brothers
911 Western Ave.
Main 4-7297

SYRACUSE 6, N. Y.
R. P. Smith Co., Inc.
2507 James St.
Howard 3-2748

WICHITA 2, KAN.
Fraser D. Moore Co.
Room 211 Derby Building
352 N. Broadway
Amherst 2-5647

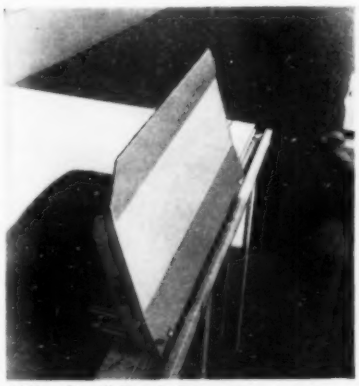
EXPORT DEPARTMENT
1010 Schaff Building
Philadelphia 2, Pa.

For more about these items, circle numbers on Reader Service Card next to back cover.



135—"Shaftex" Speed Reducer can be used with feed or tie rod as shown. It is available for 40- to 400-rpm. output speeds in sizes to 40 hp., with internal gear ratios of 5:1, 15:1, and 20:1; choice of tie rod, flange, or inclined mountings. *Allis-Chalmers Mfg. Co.*

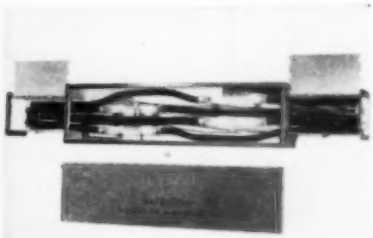
136—Dust-Tight Valve controls the discharge and flow of dry powders and granulations for equipment used in blending, milling, and like operations. New general-purpose valve is compact and stainless; available in 8, 10, 12-in. sizes. *The Patterson-Kelley Co., Inc.*



137—Steel Dock Ramp, on runners, lines up with trucks—there's no need to jockey trucks into position. Ramp, hinged to roller carrier that travels in track at edge of dock, is positioned by one man, and lowered into truck by a removable pipe handle. *Beacon Machinery, Inc.*

138—Anchor Bolt Fitting, set flush in floor, makes it easy to bolt down machines in place. A threaded stud is screwed into a floating nut located in fitting and a standard nut is used to fasten down equipment. Bolt sizes ⅜- to 1½-in. *Decatur Engineering Co.*

139—Elevated Adjustable Floor is ideal for data-processing and similar rooms that require a flexible, out-of-sight cable arrangement. Removable floor panels give easy access to beneath-the-floor cables. System is designed to support heavy loads. *Unistrut Products Co.*



140—"Safe-T-Tap" Cabinet is a new type of branch circuit connection cabinet, for use as an integral part of standard wireway runs. Cabinets are fully equipped with 400-amp. bus-bars and solderless lugs. Standard dimensions: 40x10x8 in. *Keystone Mfg. Co.*

Turn the page

NOW ... "custom plan" your conveyor system with Standard

HANDIDRIVE

and Standard units for complete belt, "live" roller and gravity roller set-ups

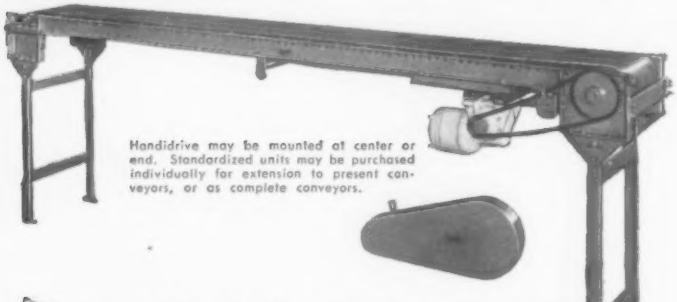
Handidrive conveyors are made up of pre-engineered standardized units, such as drives, take-up units, end roller assemblies, intermediate framework, supports and hangers.

Easy to engineer and install ... at low cost

You can assemble and build a system "custom-planned" to suit your individual needs with Handidrives and other Standard units available out of stock. This service enables you to adapt and change the system from time to time to meet varying requirements as they arise, at exceptionally low cost.

Handidrive conveyors may be individually leveled or inclined. Independent units may be purchased separately to construct power conveyors as desired.

Let Standard show *you* how to build or convert your own conveyor systems with Handidrives. Write: STANDARD CONVEYOR COMPANY. General Offices: North St. Paul 9, Minn.



Handidrive may be mounted at center or end. Standardized units may be purchased individually for extension to present conveyors, or as complete conveyors.

Ask Standard how to cut costs with conveyors

Send for Handidrive Bulletin No. 64. Write Dept. G-2

Standard

GRAVITY & POWER CONVEYORS

OVER 50 years of conveyor experience

Sales and Service in Principal Cities

FACTORY / EQUIPMENT NEWS

Begins on page 88

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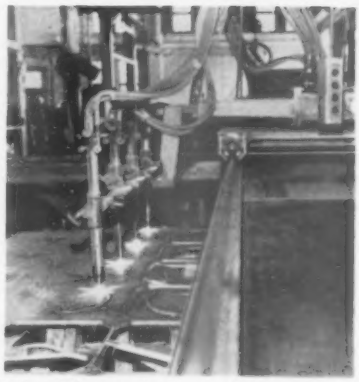


141—Electronic Tracer follows pencil-line sketches of intricate shapes and forms to guide oxygen shape-cutting machines. New photocell tracer eliminates the need for expensive metal or plastic templets, photographic negatives or costly silhouettes. *Linde Co.*

142—Vibrating Conveyor with "step-trough" moves solid granular materials, castings, and tramp iron uphill at inclines up to 25 deg. Hundreds of small "steps" in trough catch the material on the downstroke, keep it from slipping backward. *Carrier Conveyor Corp.*

143—Stainless Grooved-End Pipe systems can be installed with use of quick-coupled new fittings. Stainless steel elbows, tees, crosses, returns, sub and blank ends, reducers, and reducing tees are available in sizes from 1¼-to 4-in. dia. *Victaulic Co. of America.*

Turn the page

For more facts Circle 501 on Reader Service Card

For more facts Circle 502 on Reader Service Card ➤

The **Dayton Rubber** *Co.* *Dayton, Ohio*

Major Implement Company Saves Hundreds of Dollars Where Slippage Formerly Ruined Belts

These are the Facts:

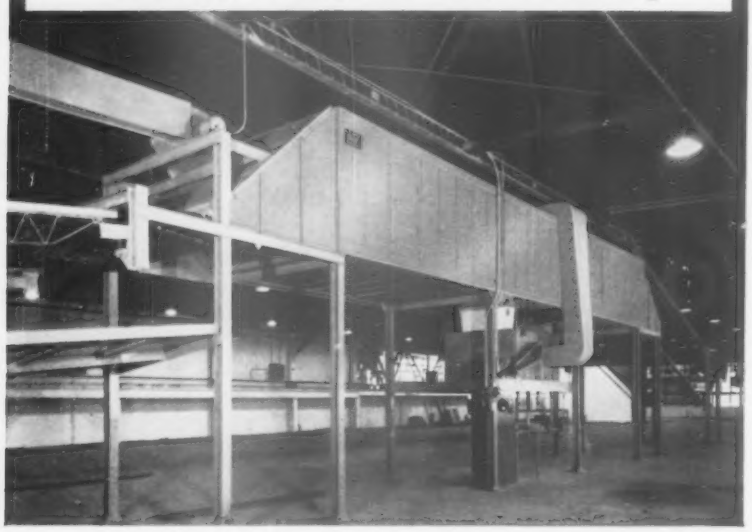
Application	Multiple drill used to gang-drill holes in engine blocks.
Drive Conditions	Requires high co-efficient of friction to combat slippage. Previous V-Belt life, 1-2 months.
Cog-Belt Results	Still going strong after 6 months.
Cog-Belt Profit	$500 and more.

YOU DON'T HAVE TO RE-SELL DAYTON COG-BELTS

See BELTING in the yellow pages of your telephone directory for the name of your local Dayton distributor or write The Dayton Rubber Co., Industrial Replacement Div., Dayton 1, Ohio

SLY INDUSTRIAL OVENS

Heavy Duty for All Needs



Sly Ovens insure better results, greater overall economy through efficient air distribution . . . close temperature control . . . maximum heat utilization . . . time-saving materials handling . . . space-saving installation. Like the "A" type oven pictured, all Sly Ovens are expertly designed and sturdily constructed to meet the particular job requirements. A complete line of conveyorized and batch types for all applications to 800° F.

See SLY for Savings Down the Line

DUST CONTROL SYSTEMS
Unequaled experience in system design plus the most extensive dust filter line. *Dynaclone* and *Automatic-Continuous* for uninterrupted, 24-hour-a-day service. *Intermittent* for non-continuous applications. Plus *"Unit"* and *"Economy"* filters.

INDUSTRIAL OVENS
Conveyorized and batch type for better results and increased savings on all baking, drying, finishing, and aging applications.

ROD BAKERS
Pit type in complete range of sizes. Reduce drying time of lime-coated rods from 30 minutes to 5. Designed to save space and coil handling time.

TUMBLING MILLS
Continuous and batch type. Remove fins as they clean castings — saving hours of machining.

BLAST ROOMS
In all types and sizes, with full mechanical return of abrasives. Thoroughly ventilated. Built to withstand years of heavy use.

PURAIR HELMETS
Complete protection against even the finest dust. Lightweight, comfortable. Maximum visibility, complete freedom of head movement.

UNIFLO NOZZLES
Steel with tungsten carbide orifice lining outlasts hard iron nozzles 200 to 1. For shot, grit and sand blasting.

PLUS . . .
Wear-resistant "Slyblast" hose. "Purair" blower units. Air pressure regulators. Abrasive elevating and cleaning units. Pressure blast tanks. Blast cabinets. Tilted blast mills. Gloves, aprons, canvas suits, leggings.

SINCE 1875 SLY

SEND FOR CATALOG describing complete line.

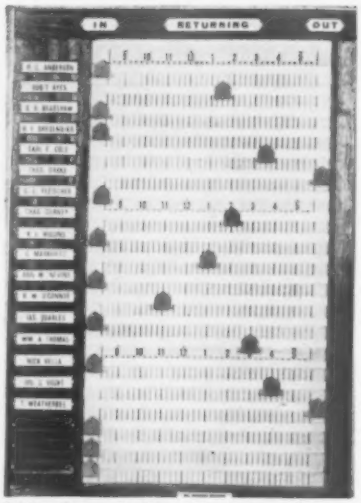
THE W. W. SLY MANUFACTURING CO.

4755 TRAIN AVENUE • CLEVELAND 1, OHIO
OFFICES IN PRINCIPAL CITIES

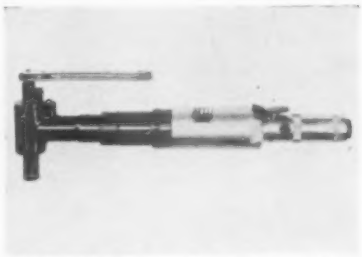
OVERSEAS LICENSEE: ANDREW AIR CONDITIONING LTD., LONDON S.W. 1, ENGLAND

Begins on page 88

For more about these items, circle item numbers on Reader Service Card next to back cover.



144—In-and-Out Register of personnel is a boon for plant switchboard operators. Device works from both sides: Personnel operate it from front and operator checks it from her side (the back) on incoming calls. No more memos or overlooked messages. *The Heirloom Co.*



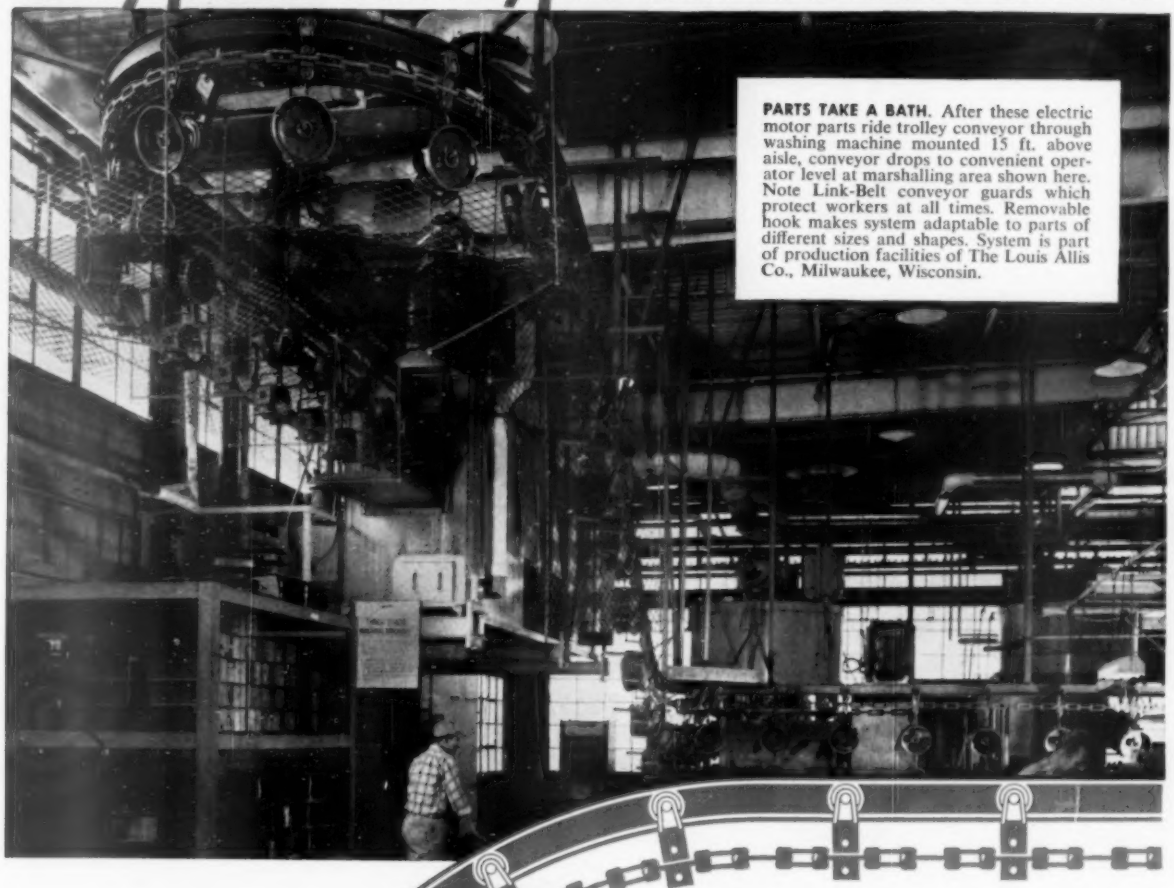
145—Air-Powered Drill for close work weighs only 5 lb. and packs more power on less air consumption, with quieter exhaust. New drill model has speed of 450 rpm., drilling capacity of $\frac{9}{16}$ in., reaming and tapping capacity of $\frac{3}{8}$ in. *Thor Power Tool Co.*

146—Swivel Fifth-Wheel and steering attachment improves load handling of portable elevating trucks. The new design replaces casters and provides a short turn radius. The load is carried on a hardened fifth wheel which makes turning easy. *The American Pulley Co.*

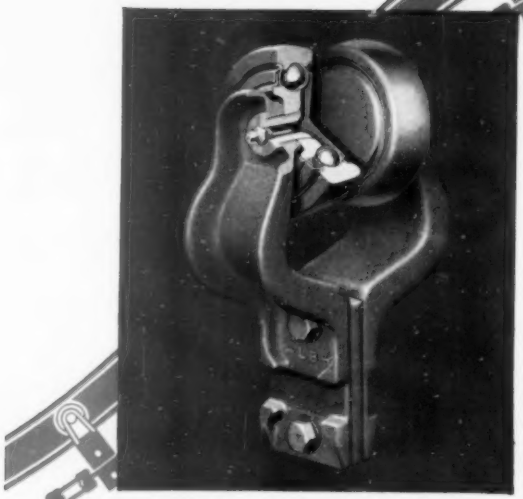
Turn the page

LINK-BELT Trolley Conveyors . . .

carry parts above, protect workers below



PARTS TAKE A BATH. After these electric motor parts ride trolley conveyor through washing machine mounted 15 ft. above aisle, conveyor drops to convenient operator level at marshalling area shown here. Note Link-Belt conveyor guards which protect workers at all times. Removable hook makes system adaptable to parts of different sizes and shapes. System is part of production facilities of The Louis Allis Co., Milwaukee, Wisconsin.



MADE IN A BEARING PLANT BY BEARING SPECIALISTS. Precision-made Link-Belt ball bearing trolleys are designed to maintain continuous rolling contact in all positions of operation. Hardened, concentrically ground raceways, accurately cage-spaced balls, frictionless labyrinth seals —all assure smooth trolley operation.

There is practically no end to the variety of parts or products that can be *safely* and *efficiently* transported by Link-Belt Overhead Trolley Conveyors. This installation is a particularly good example of how they can be adapted to carry a wide range of part sizes in perfect safety without costly building alterations.

Link-Belt Trolley Conveyors can streamline your operation wherever an uninterrupted flow of materials along a fixed route is desired. They put ceilings to work . . . save floor space . . . permit low cost movement of materials between rooms, floors or buildings . . . improve working conditions and assure effective use of manpower. Sharpen up your in-plant materials movement operation—reduce handling costs. Our engineers can analyze your methods and make recommendations from industry's most complete line of materials handling equipment. Call your nearest Link-Belt office or write today for Trolley Conveyor Book 2330.

14.838

LINK-BELT

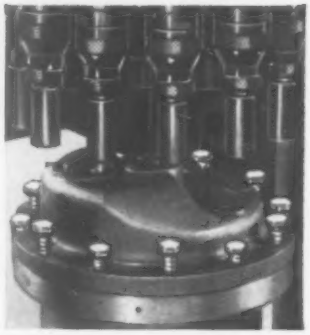
TROLLEY CONVEYORS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.

THE NEED + THE IDEA = THE PRODUCT

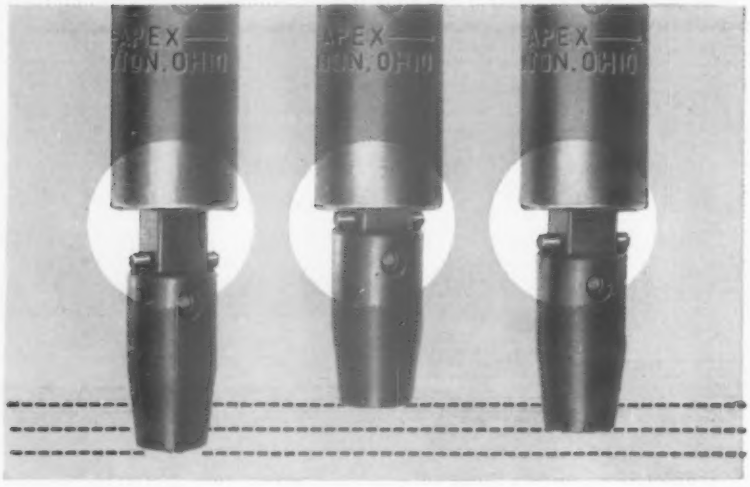
THE NEED

On multiple tool operation, where fasteners are positioned manually, the distances between sockets and mating fasteners will vary. Despite this variance, all the fasteners must be run in simultaneously and securely, without impairing the workpiece, fastener or tool.



THE PRODUCT

APEX CLUSTER SOCKETS



The Apex cluster socket, specifically designed for multiple tool applications, automatically compensates for any variation in fastener height. As the bank of power tools moves up to the fasteners, the spring-retracting action of each Apex cluster socket "levels" the fasteners, insuring uniform, positive seating and eliminating any possibility of cross-threading.

At Apex—the authority on fastening—the need creates an idea, closely followed by a new product. What's your need for special fastening tools? Our new Catalog 30-D lists several Apex "specials", one of which may solve your fastening problem—and your cost problem as well! Write, on your company letterhead please, for your copy.

APEX FASTENING TOOLS

SCREWDRIVING • NUT RUNNING • SPECIAL

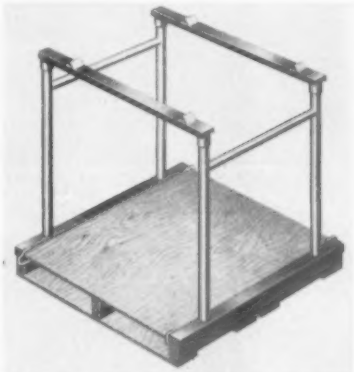
The APEX Machine & Tool Co. • 1035 So. Patterson Blvd. • Dayton 2, Ohio

FACTORY / EQUIPMENT NEWS

Begins on page 88

For more about these items, circle item numbers on Reader Service Card next to back cover.

147—Automatic Spray Decorating and mask washing combo machine is useful where a heavy material is used for decorating and only a few shots can be obtained on a mask before washing becomes necessary. Clean masks are continuously supplied. *Conforming Matrix Corp.*



148—Storage Stacking Frame, shipped and/or stored flat, easily slips on or off pallets regardless of load capacity and takes one man seconds to assemble. Model 1095 fits most pallets or skids, regardless of size, deck board or stringer spacing. *The Paltier Corp.*

149—Split Bearing is designed to permit bearing replacement savings of 75% by eliminating need for costly shaft removal. Available for standard shafts sizes $1\frac{3}{16}$ to $3\frac{3}{16}$-in. The two-piece all-bronze ball assembly is self-aligning. *Randall Graphite Bearings, Inc.*

Turn to page 108

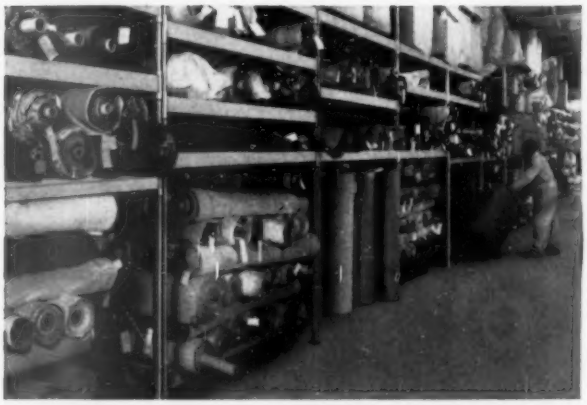
what is your material handling problem?

American

Slide-n-Lock adjustable

STORAGE RACKS

can show you the way to greater economy



because

"American" Stringers are one-piece . . . made of durable, continuous welded steel tubing, made from high carbon steel.

"American" Stringers have step construction for fast, simple conversion to decking . . . step is 1⅛" deep . . . thickness of finished 2" lumber.

"American" Posts are rugged . . . made from extra heavy gage steel . . . roll formed by special tooling.

"American" has positive double-wedging lock . . . safe-t-pin gives extra security against unhooking stringers.

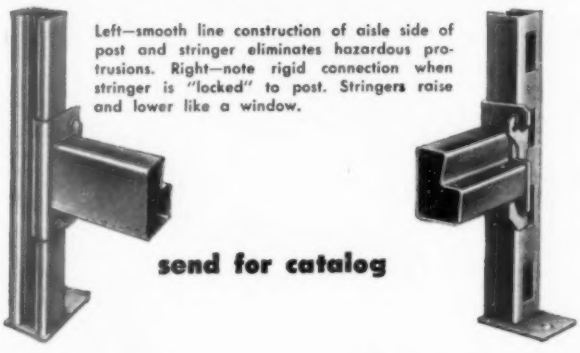
"American" has smooth, aisle-side construction . . . no protrusions of any kind to tear clothes or create a safety hazard.

"American" has higher safety factors . . . 2.25 to 1 . . . for greater protection to truck operators and merchandise.

"American" Racks are easy to erect . . . no costly bolting . . . all parts hook into place.

"American" Racks are easy to adjust . . . all stringers can be moved independently of any other part.

"American" Upright Frames are cross braced against sway . . . turnbuckles provide ready take-up for uneven floors.



Left—smooth line construction of aisle side of post and stringer eliminates hazardous protrusions. Right—note rigid connection when stringer is "locked" to post. Stringers raise and lower like a window.

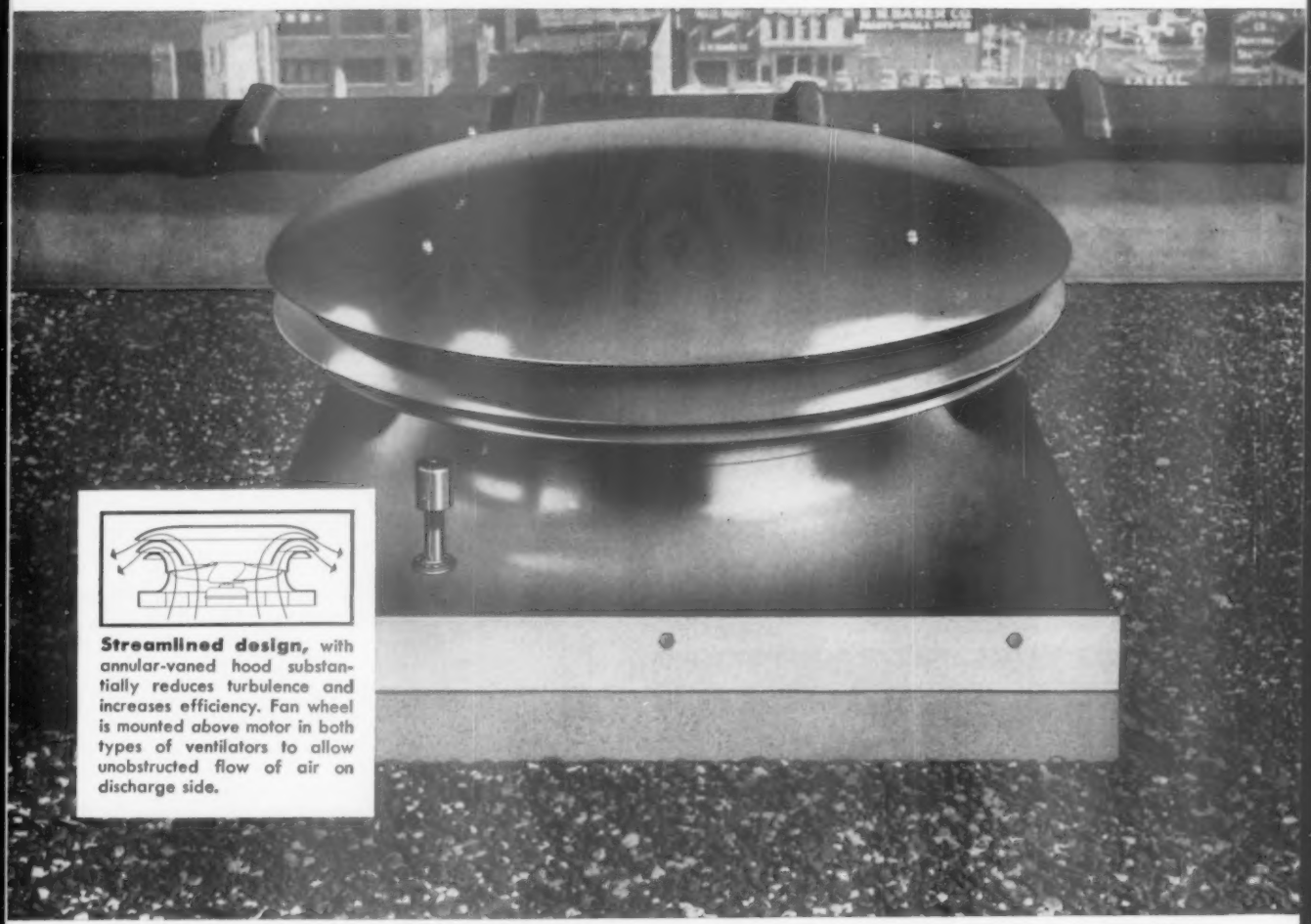
send for catalog

AMERICAN METAL PRODUCTS COMPANY

STORAGE RACK DIVISION

5959 Linsdale Ave. amp® Detroit 4, Michigan

Now! Low cost the Trane Axial

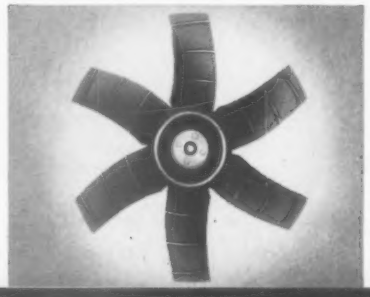


Streamlined design, with annular-vaned hood substantially reduces turbulence and increases efficiency. Fan wheel is mounted above motor in both types of ventilators to allow unobstructed flow of air on discharge side.

Hooded type Axial Roof Ventilator has specially engineered annular turning louvers to reduce pressure loss. May be used for exhaust or summer supply. Meets blackout requirement. Available with three types of positive or gravity dampers.

Vertical exhaust ventilator. This type of new TRANE Axial Roof Ventilator is used to exhaust hot or dirty air. Discharges air straight up, away from roof. Sloping gravity dampers open when fan starts, close when fan stops.

Model B fans—3 or 5 bladed—are furnished with TRANE Axial Roof Ventilators. Fan blades are arc-welded to the spun fan hubs. Stiffeners spot-welded to blades for added reinforcement.



ventilation with Roof Ventilator

New from Trane . . . a low silhouette, high efficiency ventilator that's completely accessible from the roof!

Here's a roof ventilator that will provide economical ventilation for mills, factories, warehouses and all large buildings with open type interiors. It's the new TRANE Axial Roof Ventilator—designed to provide lower silhouette, lower initial cost, low power consumption, complete accessibility from the roof.

Available in two basic types—hooded or vertical exhaust—the new TRANE Axial Roof Ventilators come in five sizes: 24, 30, 36, 42 and 48-inch fan wheel diameter. Models are available to handle corrosive and explosive fumes and gases.

Easy to maintain, these ventilators have easily accessible motors and drive belts; complete assembly pivots for fast service or inspection.

Next time you're planning a factory or commercial ventilation job, make it TRANE! For complete facts, just call your nearby TRANE Sales Office or write TRANE, La Crosse, Wisconsin.

Check these features!

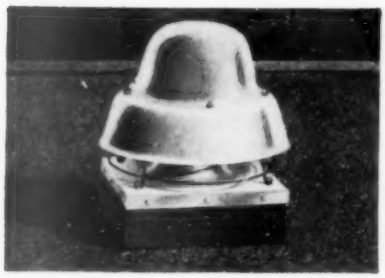
- *AMCA Certified Rating Seal*—Units tested and rated according to the Standard Code of the Air Moving and Conditioning Association (AMCA) and the ASHAE.
- *Low silhouette*—For trim appearance. 24-inch ventilator is only 19 3/16" above roof line.
- *Easy maintenance*—Hood slips off easily for access to motor and belts. Complete assembly pivots. Safety switch on unit permits maintenance man to disconnect fan for service.
- *Quality construction*—All wheels are scientifically balanced. Blades are blanked and die-formed complete with beads to insure permanent set of blade contour. For added reinforcement, stiffening plates are spot-welded to each blade. Motors are totally enclosed.
- *Versatile*—Complete range of five sizes from 24-inch to 48-inch wheel diameter. Two basic types: vertical exhaust, and hooded exhaust or supply. Models available to handle corrosive and explosive fumes and gases.
- *Safe*—Units are available with built-in spring and fusible link to control damper in presence of fire.

For any air condition, turn to

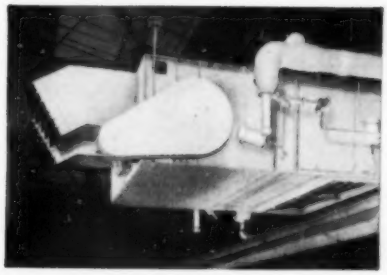
TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

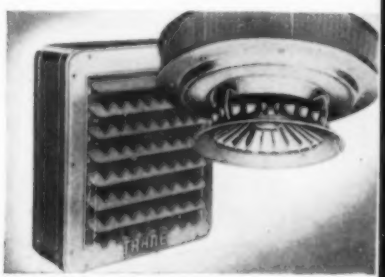
THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA.
TRANE COMPANY OF CANADA, LTD., TORONTO • 96 U.S. AND 18 CANADIAN OFFICES



Centrifugal Roof Ventilator for quiet, high-volume ventilation against higher static pressures. Streamlined, lightweight, compact, easy to install. 16 fan sizes from 7" to 40" wheel.



TRANE Torrivent heats and ventilates large areas. Rugged, efficient centrifugal units handle up to 33,000 cfm. May be installed on floor, ceiling or wall, with or without duct work.



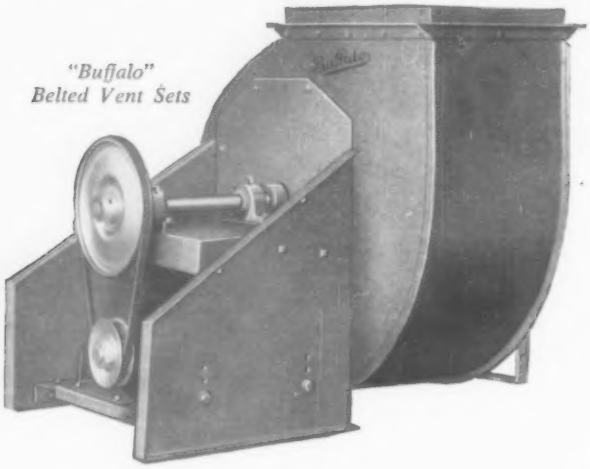
TRANE Unit Heaters—Horizontal or Projection types—put the heat where you want it! Patented diffusion feature gives an unlimited number of heating patterns.

For more facts Circle 507 on Reader Service Card

LOW-COST, VERSATILE "PACKAGES"

FIT MANY PLANT VENTILATING NEEDS

"Buffalo" Belted Vent Sets



- **Small, Independent Plant Systems**
- **Larger Systems with Variable Requirements**
- **Separate Systems in Different Plant Areas**
- **Meeting Future Plant Expansion Needs**

"Buffalo" Belted Vent Sets are low-cost "package" ventilating units. Economical to install and operate, they provide quiet, efficient performance. They can be "spotted" singly where needed, or used as multiple units to ventilate larger areas. Fan capacities are easily adjustable to meet future requirements. High efficiencies are the result of the smoothly-curved "Buffalo" inlet vanes. Backward-curved blades give non-overloading characteristics. Available with all-weather drive cover for outdoor installations. Can be ordered with special protective coatings or special materials for use as fume hood exhausters. Capacities range from 500 to 20,000 CFM.

Call your nearby "Buffalo" engineering representative for complete facts about economical, flexible "Buffalo" Belted Vent Sets. Or write for Bulletin 3720-A.

"Buffalo"

BUFFALO FORGE COMPANY
471 Broadway, Buffalo, N. Y.

Buffalo Pumps Division Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

INDUSTRIAL EXHAUSTERS • BELTED VENT SETS • PROPELLER FANS • "E" BLOWERS-EXHAUSTERS

FACTORY / EQUIPMENT NEWS

Begins on page 88

For more about these items, circle item numbers on Reader Service Card next to back cover.

150—Outdoor Floodlights that stand up in rain, sleet or snow—even when used face-up—are part of new line of bell holders for use singly or in clusters. All-weather seals of silicone rubber cushion the lamps against vibration, pole-whip. *Stonco Electric Products Co.*

151—"Duralast" Wheel Tread is said by maker to combine the long tread life and heavy load-carrying capacities of metal and plastic wheels with the noiseless, floor-protective qualities of rubber. Wheels come in sizes from 4-in. dia. up. *Hamilton Caster & Mfg. Co.*

152—All-Electric "Jenny" cleans and sanitizes in areas where flame, smoke, or fuel fumes would be hazardous. This quiet new electric steam cleaner is said to be ideal for light- to medium-duty cleaning and to prevent rusting of equipment. *Homestead Valve Mfg. Co.*

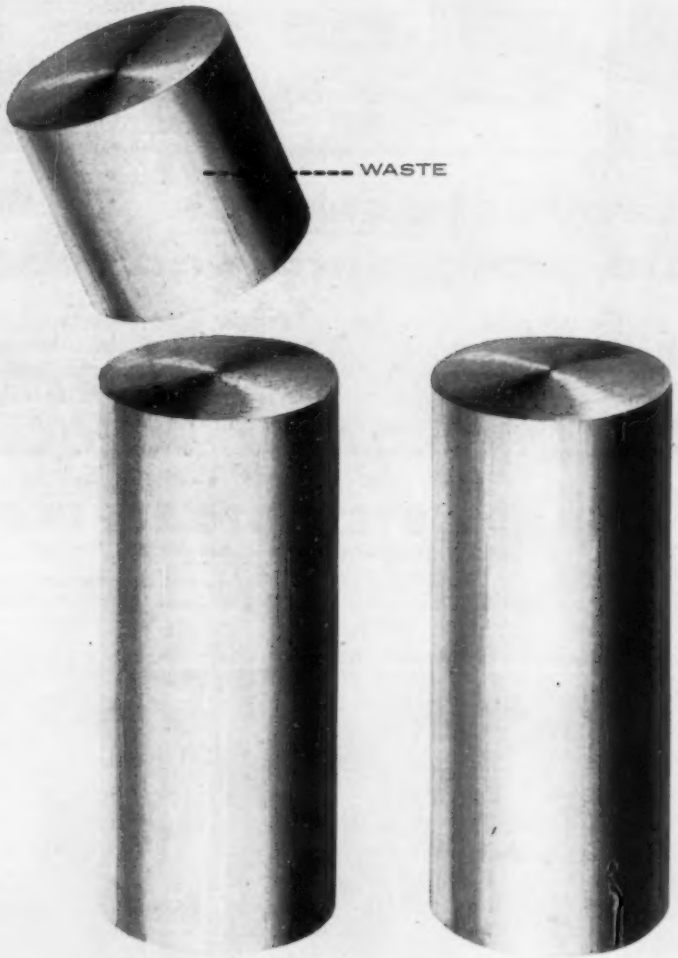
153—Portable Conveyor for loading and stacking packages is supplied with wheel-mounted support ahead of or behind the gearmotor at end of conveyor. Bed lengths are 10 and 15 ft. with 15- or 25-deg. incline; 12- and 18-in.-wide belts. *Conveyor Specialty Co., Inc.*

Turn the page

For more facts Circle 508 on Reader Service Card
For more facts Circle 509 on Reader Service Card ➤

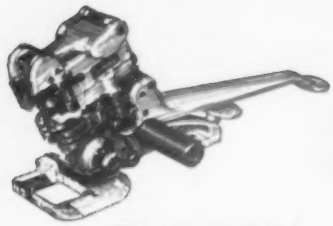
"Good riddance to remnant loss" with Asarcon 773 bearing bronze. No more scrap ends from short cast bars. Buy Asarcon 773 (SAE 660) in just the length you need for a specific job; or buy and stock the sizes you commonly use in the lengths which fit your everyday needs best. Asarcon® continuous-cast bearing bronze comes in 260 stock sizes, solids and tubes, in lengths up to 105″. For nearest stock point, write Continuous-Cast Products Department, American Smelting and Refining Company, Barber, N. J. West Coast Sales Agent: Kingwell Bros., Ltd., 457 Minna St., San Francisco. In Canada: Federated Metals Canada, Ltd., Montreal and Toronto.

CONTINUOUS-CAST DEPARTMENT OF

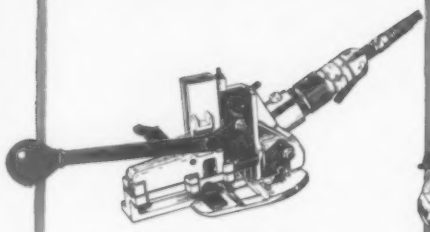


ASARCO

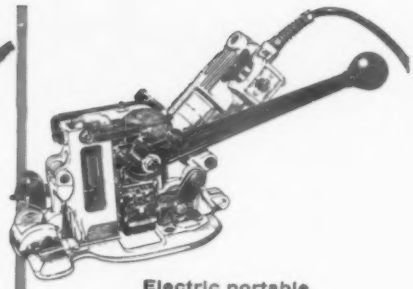
AMERICAN SMELTING AND REFINING COMPANY



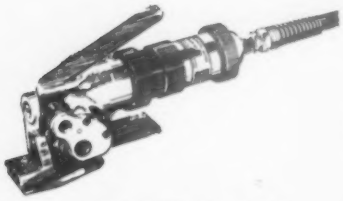
The only one-hand strapping tools
SFC Series



Air power portable strapping machines
AP Series



Electric portable strapping machines
AE Series



Complete line of air power tensioning tools
PN Series

The only air power feed wheel tensioning tool for heavy duty strapping

FN Series

Heavy-duty air power sealers
N Series

Make your product cost less to handle, store, ship, and receive

Binding things together with steel strapping is a low cost way to eliminate individual handlings, save space, and prevent damage. These nine machines—part of the most complete line of equipment in the steel strapping industry—create new ways to save with strapping. Signode will be glad to help you select the right equipment and devise methods to make the most of it. There's a Signode man near you. Call him today, or write:

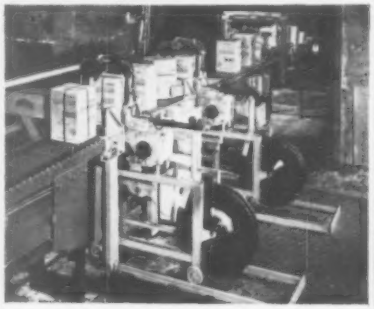
First in steel strapping

SIGNODE STEEL STRAPPING CO.

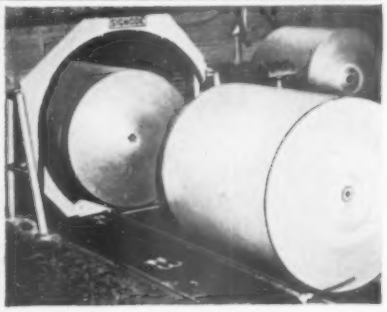
2663 N. Western Avenue, Chicago 47, Illinois

Offices Coast to Coast. Foreign Subsidiaries and Distributors World-Wide
In Canada: Canadian Steel Strapping Co., Ltd., Montreal • Toronto

Power strap feeders
Model PSF



Fully automatic carton strapping machines—Model M2N



Fully automatic roll and coil strapping machines Model M20RB

For more facts Circle 510 on Reader Service Card

CM

Lodestar®

electric hoist

now... important new models

LARGER CAPACITY

FASTER SPEEDS

GREATER SELECTION...from a complete range of capacities and speeds ...1/8 to 2 tons and 8 to 60 fpm.

Here's your opportunity to slash lifting and handling costs. Put these new Lodestars to work where their increased speeds and capacity match your maximum requirements.

LODESTAR FEATURES INCLUDE:

- Safe, Heavy Duty Performance
- Lowest Headroom
- Push Button Control
- Fully Enclosed Components
- Self-Adjusting Magnetic Brake
- Ultra-Modern Electric Braking
- CM-ALLOY Flexible Link Chain
- Minimum-Maintenance Operation
- Lifetime Lubrication

Request catalog and name of local stocking distributor.

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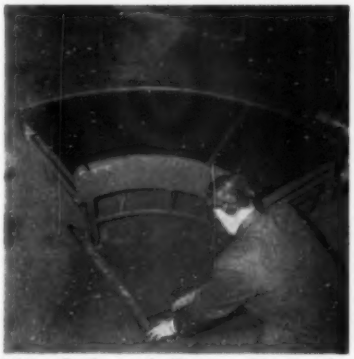
CM HOISTS

Circle 511 on Reader Service Card

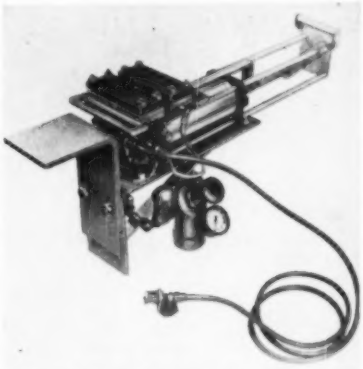
FACTORY / EQUIPMENT NEWS

Begins on page 88

For more about these items, circle item numbers on Reader Service Card next to back cover.



154—Series of Power Turns for existing conveyor systems eliminate transfer points while keeping flow of products constant. Available in 30- to 180-deg. units, fitted with reducers for speed regulation in conjunction with installed systems. *Central Conveyor Co.*



155—Portable Stock Feed Unit, air-operated, converts hand-fed punch-press jobs to safe, faster automatic feeding. No solenoids, thus no electrical connections needed. Unit can be mounted in minutes without links or rods; 4 sizes. *Cleveland Pneumatic Industries, Inc.*

156—Diesel Generator Control center incorporating generator switchgear, automatic transfer switch, engine start control, and battery charger is integrated in single cabinet that can be engine- or wall-mounted. Capacities to 800 amp., 600 v. *Lake Shore Electric Corp.*

Turn the page

How Much Service Does Your Maintenance Dollar *REALLY BUY?*

Lots More When You Specify Maintenance from Your Nearest G-E Service Shop!

YOU GET...

A ***modern*** approach to apparatus maintenance that can help lower your costs, reduce downtime, achieve more economical production line operation. A-c motor repair in 12 hours, in-plant maintenance consultations, high quality materials, experienced workmanship . . . you get all this, and many other benefits ***at no additional cost.*** Clip the coupon below and send it in today for more information on what General Electric's Service Shops can do for you.

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Schenectady 5, New York

Yes, send GED-3465, "Ten Service Benefits."

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ADDRESS_____

Service Shops Department

GENERAL ELECTRIC

Circle 512 on Reader Service Card

interchangeable with all standard JIC cylinders

With the introduction of the ALL NEW T-J Squair Head, Tomkins-Johnson now offers industry the most complete design range of air and hydraulic cylinders. Presently available in bore diameters from 1-½ to 8 inches, the T-J Squair Head is an interchangeable cylinder which produces maximum force and efficiency, with minimum pressures . . . and is also adaptable to the use of low pressure oil as the working medium. Write today to The Tomkins-Johnson Co., Jackson, Michigan, for Bulletin #SQ 10-58 and complete details.

CHECK THESE 10 POINTS OF T-J SUPERIORITY

1. One Piece Piston
2. Hard Chrome Cylinder Bore and Piston Rods
3. High Tensile Steel Tie-Rods
4. Cushion Adjusting Screw, Externally Adjustable
5. New Super-Cushion for air, or Self-Aligning Master Seal for oil (T-J Patents)
6. Solid Steel Heads and Mounting Plates Standard all Models
7. Port Design Allows Minimum Pressure Drop on Inlet or Outlet
8. Chevron Type, Self-Adjusting Rod Packing
9. Piloted Packing Gland—Absolute Alignment
10. Piston Rod, Extra Strong—Polished and Chrome Plated for Efficiency and Protection

T-J TOMKINS-JOHNSON
RIVITORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS

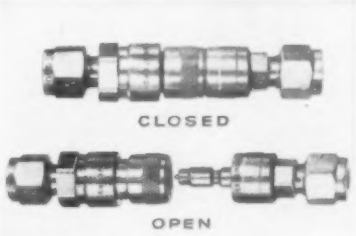
For more facts Circle 513 on Reader Service Card

FACTORY / EQUIPMENT NEWS

Begins on page 88

For more about these items, circle item numbers on Reader Service Card next to back cover.

157—Lightweight Scaffolding units of magnesium weigh 62 lb., withstand up to 600-lb. distributed loads. Collapsible sections and guard rails interlock on sleeve tube. Basic unit forms platform 9 ft. high, 7½ ft. long. *White Metal Rolling & Stamping Corp.*



158—Quick-Connect Swagelock fitting features instant-acting seals on both ends, preventing pressure loss from either end when disconnected by push-pull action. Useful for portable equipment and panel applications. Available in ¼- or ⅜-in. OD tube. *Crawford Fitting Co.*

159—Air-Powered Hoists, hook and trolley types, available for installations requiring infinitely variable hoisting and lowering speed and extremely close load-spotting control. Link and roller chain models of 1000- and 2000-lb. capacity. *Yale & Towne Mfg. Co.*

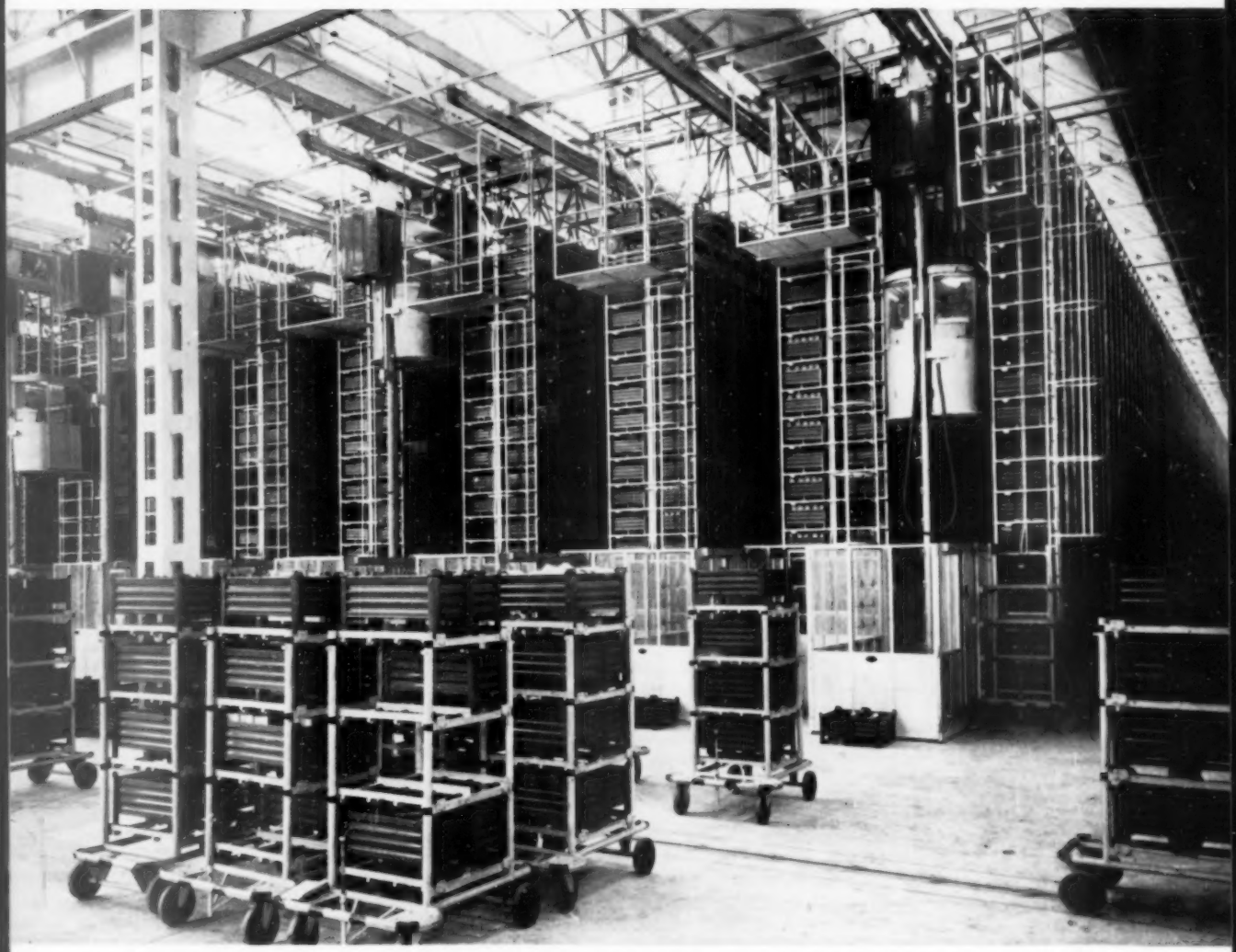
Turn to page 134

FACTORY

PLANT OPERATING MANAGEMENT

CASE BOOK

WARREN J. KING
Manager, Features and Departments



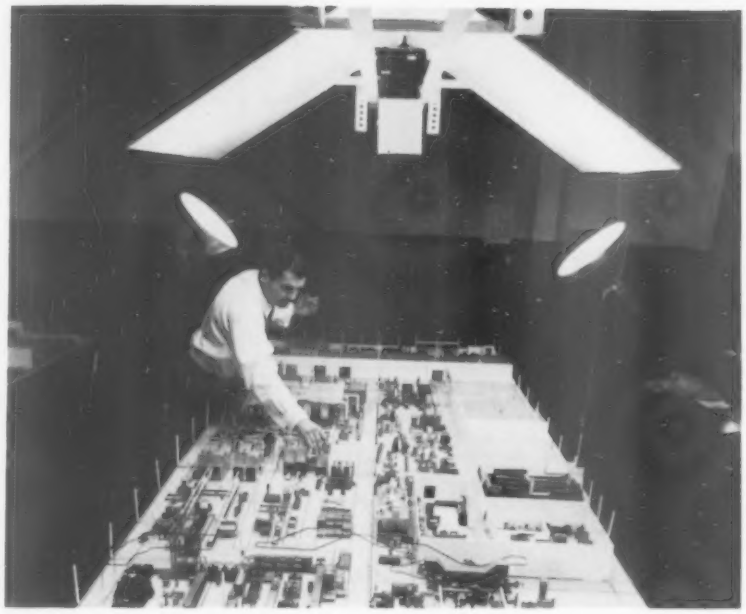
UNIQUE LIFT DEVICE TRANSFORMS AIR SPACE INTO STORAGE SPACE IN THIS PLANT . . . PAGE 115

HIGHLIGHTS: Tips on the handicapped (p. 115) . . . check your hiring performance (p. 116) . . . cuts drying costs (p. 118) . . . slices steel like soft butter (p. 118) . . . salvage news (p. 120) . . . motor juggling saves the day (p. 120) . . . one man replaces three (p. 122) . . . TV to the rescue (p. 126) . . . cutting clean-up costs (p. 128)

FACTORY
CASE BOOK

NO. 17 FEBRUARY 1959

Makes Layout Planning Easier 114
Tips on Placing Handicapped Workers 115
High-Level, High-Speed Storage 115
Manual Tells Best Way to Ship 116
Gets Rid of Unwelcome Impurities Completely 116
Better Check Your Hiring Performance 116
It's Not a Stairway to the Stars 117
Silences Noisy Foundry Shrieks 117
Vertical Ovens Cut Drying Costs .. 118
New Shipping Pack Cuts Damage .. 118
Cuts Steel Like Butter 118
Suggesters Win Company Stock 118
Little Tricks Make Operation Smoother 119
Puts Switches in Open View 120
This New Salvage Idea Speeds Tooling 120
Motor Juggling Saves the Day 120
Makes Boat Building Look Easy 121
One Man Now Replaces Three 122
Shuffled Line-up Smooths Operations 122
Paper Separators Cut Warehouse Cost 122
Newest Phone Dialing System 122
Tailored Tools Tame Tough Tasks .. 123
You Be the Arbitrator 124
Gains From Incentive Pay 124
Special Conveyor Speeds Up Assembly 124
Gets Materials in Faster 125
Case Book Capsules 125
Rack Saves Air Space and Packers' Time 126
Company Makes Good Credit Union Loss 126
Ten Cameras Keep Watch on 43 Truck Docks 126
Repairs Don't Stop Production 126
Here's Some Real Automatic Handling 127
Down With Those Clean-Up Costs .. 128
Floats Your Jigs Right Into Place 128
Clerk Sorts Mail While Truck Rolls 128



Makes Layout Planning Easier

Photography and three-dimensional plant layout models work together for manufacturing engineers at Westinghouse Electric's air conditioning plant in Staunton, Va. Combination has eliminated the necessity of preparing two-dimensional layouts or drawings of area rearrangements. This saves time and cost of new installations. In addition, it's obviously more convenient.

A room adjacent to the manufacturing facilities housing the eight-section, 3-D layout model of the Staunton plant has an unusual feature. It's equipped with a trolley-mounted Speed Graphic camera hanging from two overhead steel beams. The arrangement lets layout engineers photograph any part of the plant while sections rest on separate tables. Pushing the tables together gives a composite view of the plant. But normally they're pulled apart for easier access. Leveling screws on the table legs facilitates moving and maintaining a uniform level for the entire work area when the model is pushed together.

Proper illumination comes from photoflood lights placed next to the tables being photographed. These are focused upward on an overhead aluminum sheet that reflects light back down on the proper area. Lights are placed above the line of vision of the camera lens. And to make sure no light rays beam directly on the lens, the camera is fitted with a specially designed shade. Reflected instead of direct light is used to eliminate bright spots and shadows in the pictures.

In an actual rearrangement, several new layouts are usually made before the right one is worked out. For the record, each is photographed before the next is made. Where the area undergoing the change is larger than one picture can cover, a sequence shot is taken. Then individual shots are matched and bound together with masking tape. The works engineering department proceeds with modifications or new installations working directly from photographs. Matt prints are used (not glossy prints) so maintenance men can make additional notes directly on the pictures.

The layout room itself has a workshop with power tools and work benches for building new and altering old models, plus a photographic darkroom and print storage area. A precipitron keeps both shop and model room air clean. Experience demonstrated that a 3-D model is difficult to work with unless it's absolutely clean.

Source: B. E. Tupper, Manager, Manufacturing, Air Conditioning Division, Westinghouse Electric Corporation, Staunton, Va.

Tips on Placing Handicapped Workers

Here are some impressive statistics on handicapped workers at Bell Aircraft Corporation. During one six-month period 45% of employees placed had known physical defects. Of these, 25% were actually handicapped. But only 3% were restricted on jobs assigned.

Secret behind these figures is a carefully developed procedure for handling placement of handicapped workers at Bell. It's a system that evaluates physical restrictions as part of each worker's employment record.

Here's how:

1. Each supervisor makes a safety analysis of each job in his department. This shows the steps required for each operation, hazards involved in each step, precautions needed to avoid accidents.

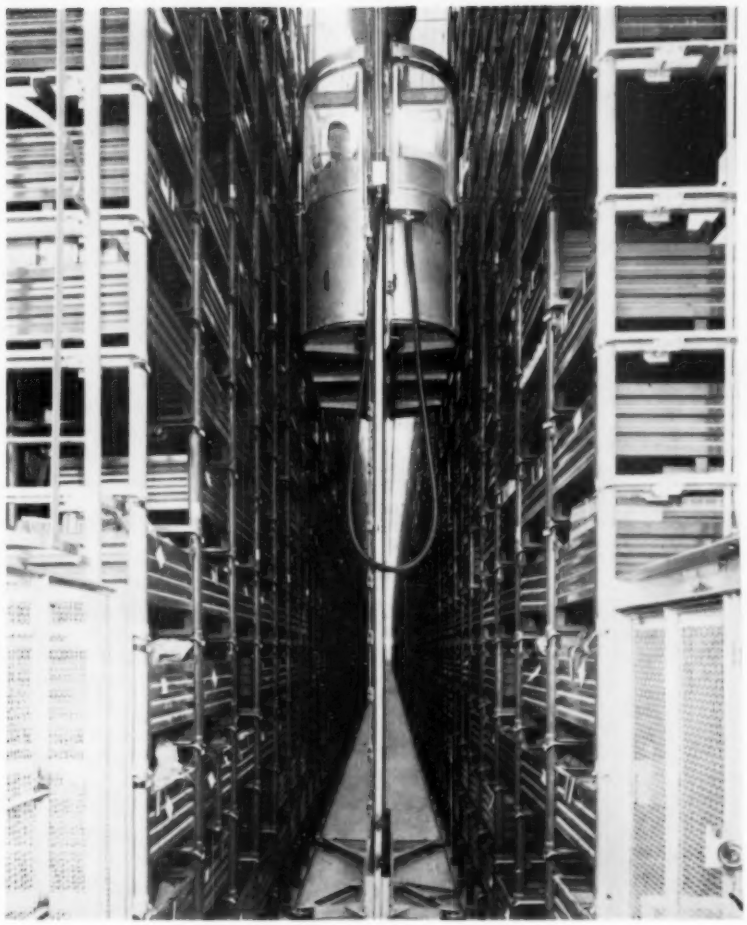
2. Following each physical examination the medical director studies the worker's restrictions in terms of job demands, then tells the supervisor of the handicapped person's ability to meet them.

3. If the medical director decides the applicant is incapable of safe performance of the job, representatives of employment, medical, safety, and production departments meet to attempt to find a job that fits the applicant's disabilities. Actually, few meetings are necessary. Experience from years of hiring has taught interviewers and supervisors to evaluate quickly and accurately the limits of the handicapped.

4. Safety engineers follow up the placement. They observe the man on the job, determine if the work is beyond his capabilities. Check-ups are made periodically, with frequency depending on the type of restrictions involved. The safety department has access to records on employees' physical conditions. But these records are coded to keep the information confidential.

5. Transferring of handicapped employees is not permitted without prior approval of the safety engineer. And the medical director participates in this decision, too. He approves a transfer only if there's no question of the employee's ability to perform the new job.

Source: T. R. Leadbeater, Safety Director, Bell Aircraft Corporation, Buffalo, N. Y.



High-Level, High-Speed Storage

(cover story)

The unusual looking warehousing operation that's shown on the cover is what you'd call a well-stacked storage area. And it's serviced by 16 unique elevator-type devices like the one shown above. The installation occupies 62,000 square feet. It provides storage facilities for 70,000 different items at the Fiat Company, Turin, Italy. Individual racks are over 31 feet high, 244 feet long. Over-all, they have a capacity of 120,000 pallets.

The project resulted from some creative engineering by the Italian automobile manufacturer. Upset by the low-volume storage per square foot of floor space offered by conventional warehousing methods, Fiat staff engineers did some blue-sky planning.

They figured that if they could make better exploitation of air space, they would save money in the long run even though initial cost of handling and storage equipment was greater. Result of their thinking was this elevator-rack system.

One specially designed elevator takes care of each aisle. Carrying an operator and palletized loads, units travel horizontally, vertically, or diagonally to reach the proper storage slot. A control panel lets the operator select the most efficient direction for the elevator, stop at the proper rack level, and regulate speed en route. Maximum horizontal speed is 72 fpm., vertical 210 fpm.

The elevators hang from overhead beams that also serve as a track for horizontal movement. At the same time, a floor frame uses horizontal guide wheels to center the horizontal motion and add stability. Vertically, the car moves up and down two

columns passing through the front and rear of the cabin. The overhead beam also supports the motor unit and hoist providing the power for all moves. The system transfers 5000 parts daily to and from storage. Fifteen elevators are designed to carry two standard-size palletized tote boxes. These units measure roughly 25x28 and 25x14 inches. Each 18-level rack holds 4788 of the larger units or as many as 9576 of the smaller.

The sixteenth car transports larger and heavier tote boxes with bigger parts to a seventeenth rack. This sixteenth car is slightly larger than the other units, and it has a special fork attachment for mechanically loading and unloading parts.

Each elevator unit cost about $12,000 and has a one-ton capacity. Elevators for handling the standard-size tote boxes have built-in four-level racks. These line up with the similar construction of the four-level trucks used to take parts to and from the storage area. Thus palletized loads can be transferred in and out of the elevators with a minimum of effort. And further to facilitate transfer of the palletized tote boxes, rollers have been installed on the horizontal members of the elevator, truck, and 31-ft. high stationary racks.

GETS RID OF UNWELCOME IMPURITIES COMPLETELY

Using downstream water from a steel mill, sewage disposal plant, and several other mills was a problem for J. J. O'Donnell Woolens, Inc., Farnumsville, Mass. To dye cashmere and high-quality woolens properly, O'Donnell had to remove all unwelcome impurities from process water. This wasn't easy until a coagulant aid manufactured by Hagan Chemicals & Controls Inc. (Pittsburgh) came along. The dry aid is first mixed in a 200-gal. tank (photo above). Then the slurry is fed into clarifiers through a solenoid valve to get just the right mix.

Manual Tells Best Way to Ship

When you're purchasing transportation for inbound and outbound shipments, you're interested in two factors—economy and service. To control this activity, General Electric's Industrial Heating Department has put together a 63-page manual for routing traffic. The manual contains detailed information on routing, tracing, and expediting shipments. It also covers a comparison of charges, insurance regulations, and claim development.

The payoff in using the manual: a 15% reduction in shipping costs during the first six months. And during this period only about 33% of the cities involved in shipments were listed. Eventually, G-E hopes to control 85% of shipments, realize savings of 25 to 30%.

Buyers and expediters alike use the manual, issue shipping instructions on incoming and outgoing orders. Now let's see how the manual works for an order of soldering-iron tips from Chase Brass Company in Waterbury, Conn.:

When making the purchase, the buyer also issues shipping instructions to the vendor. To do this he refers to the state and city listing for the location of the vendor's plant. For Waterbury he finds shipments weighing less than 20 pounds are best routed by parcel post. Those weighing between 21 and 40 pounds should go via express, those over 40 pounds by truck. In the latter case, the manual tells exactly what truck route should be used, too. Then a final bit of information estimates the length of time needed for each method of shipment.

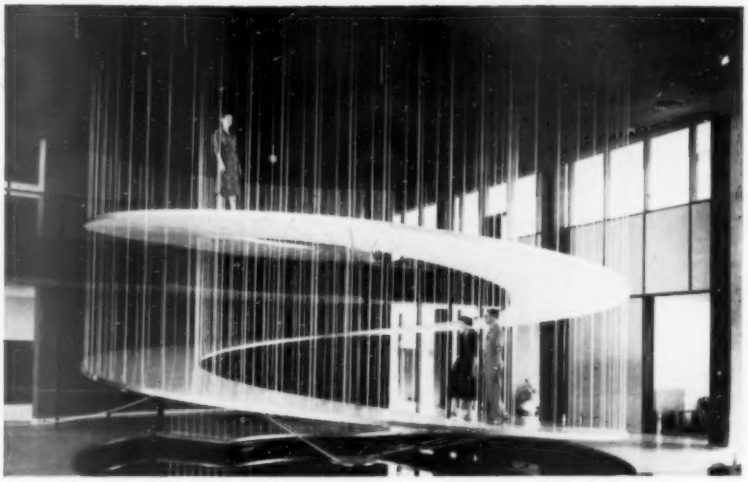
Similarly, routings to any point in the country can be determined in minutes. But naturally the manual doesn't—and never will—cover 100% of the shipments arriving at and leaving the plant. In special cases such as "rush" orders, representatives of the traffic department are always available to provide best route information.

The easy-to-use information in the manual took 80 man-hours to compile. Then each potential user was given one hour's instruction in its use. To keep the manual up to date, its pages are being revised and added to continually.

Source: W. J. Pierce, Supervisor, Traffic, Industrial Heating Department, General Electric Company, Shelbyville, Ind.

Better Check Your Hiring Performance

Think you do an adequate job of pre-employment checking? If you think so, you'll want to check yourself against the following 12 items. If you think not, here's a good chance to put your finger on your weak spots. The list of items is based on the 25,000 investigations of Bates



IT'S NOT A STAIRWAY TO THE STARS

It's the last word in graceful footpaths at Convair-Astronautics' new plant in San Diego. The 245-ft. spiral ramp in the two-story lobby hangs from the ceiling on high-tensile aluminum rods. It's suspended over a reflecting pool on the ground floor of the glass-walled reception center located between the two main buildings at the new site. The ramp leads to briefing and conference rooms on the second floor. The plant, incorporating the latest in architectural concepts, was built for missile development and production.

Associates (White Plains, N. Y.), one of the authorities in the field.

1. Do you make a routine check of police records? Few employers do. It's a simple, basic precaution, could save you stolen or damaged property. And could help spare you much disruption.

2. Do you faithfully check business and personal references? And do you make a personal field check whenever possible? The former employer of a mechanic gave him a fair recommendation over the phone. When followed up, former employer talked further. Truth was he hadn't wanted to give a poor recommendation over the phone because of the applicant's large family. But the mechanic had been fired for attacking his foreman with a knife.

3. Are you alert to references who build a case for the man on a particular trait? For example, you call a former employer. He avoids questions about the man's work, talks about how cooperative he is. This can mean the applicant was a poor worker. But former employer wants to give him a break.

4. Do you positively determine the exact reason the man left his previous job? The standard reasons are left "for more money" or "for a better opportunity." Simple arithmetic will help you here. For example, if the man is applying for a lower paying job than he left, there's something wrong with the "quit for more money" argument. It's surprising how often this happens.

5. Do you make sure all the applicant's previous jobs and residences are accounted for? If there's a year or two missing from his history, it could be significant.

6. Do you check credit and litigation records? Even lower-echelon employees with financial or legal trouble can be a giant-size problem. A typist for one aircraft manufacturer tried to sell some plans to a rival company. Reason: She had three judgments against her and was desperate. Obviously she wouldn't have been hired if a credit check had been run.

7. Do you check out military experience that seems important to the job? Applicants have a habit of creating important rank for themselves. And they have a habit of making military experience relate to the work they're applying for.

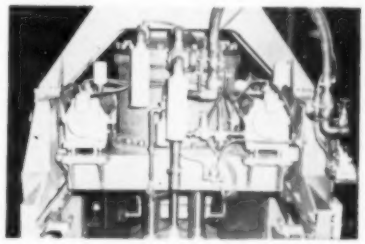
8. Do you make a special effort to get all the background information on applicants whose address or employment has changed often? Annual movers often (but not always) have a record of alcoholism or unreliability.

9. Do you check against name changes for employees who will have highly responsible jobs? If the applicant will handle money or other valuables, it pays to send a photograph when checking police records. The applicant may have changed to the name of a respectable person, may have a police record as long as your arm. A lot of trouble? Maybe, but it can be worth it.

10. Do you place heavy emphasis on appearance? Many a top-notch production man fails the appearance test. But an exhaustive check of his background may induce you to take on a man whose appearance has practically disqualified him.

11. Do you give up on applicants with foreign employment on their records? It can be checked. An applicant for a responsible supervisory job in an eastern refinery looked like an excellent bet based on his domestic work history. But his last job had been with an oil company in Arabia. And while there he had become a drug addict.

12. Do you make investigations a routine, or just a spot-check? If you use the spot-check technique, consider the paint and varnish plant that checked 77 consecutive applicants before a problem applicant turned up. But the 78th applicant's police record proved him to be a confirmed firebug. Just not the type to have around a paint plant.



Silences Noisy Foundry Shrieks

The tube in the middle of the photo that looks like a muffler is just that. It's an Atomuffler (Allied Witan Company, Cleveland). And it takes the shriek out of the 120 decibels given off by automatic foundry machines made by the SPO Com-

pany, Inc. (Cleveland). SPO uses mufflers as an integral part of its machines. The mufflers stop high-speed dust scatter while silencing repeated blasts of noise. Result? Machines can be operated at increased production rates because now there's no adverse worker reaction as frequency of exhaust is increased. Also, keeping down dust and sand cuts maintenance costs.

Vertical Ovens Cut Drying Costs

Four 22-ft. high and 5½-ft. wide infra-red ovens have cut fuel costs at Globe Woven Belting Company's Buffalo, N. Y., plant. Also have improved process control, reduced warm-up time, and greatly increased flexibility in drying woven belts. Formerly Globe dried woven belting with steam.

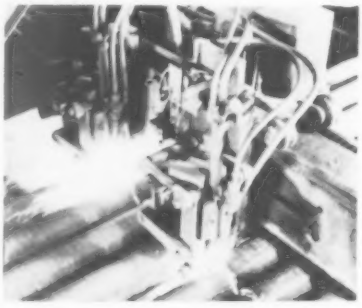
Key feature of Globe's new ovens (Fostoria Pressed Steel Corp., Fostoria, Ohio) is an automatic control center designed to minimize operating costs. It programs the entire drying cycle, energizing the ventilating fans before switching on heat lamps, and presets the heating rate for optimum results.

Varying heat from "candle-flame" intensity to 500 watts per square foot is accomplished by controlling the number of lamps in use. When narrow belting is run, only lamps facing the belt are energized. This avoids wasting electricity and, Globe reports, belt shrinkage is reduced. Furthermore, Globe can now dry wider and lighter gages of fabric because "whipping" caused by air currents is gone.

New Shipping Pack Cuts Damage

A lightweight, form-fitting polystyrene pack now insures damage-free shipment of electric typewriters made by Royal McBee Corporation (Hartford). And the new 3½-lb. pack makes for faster, more efficient packaging of the 47-lb. machines, too.

The compact case is molded "cocoon style" inside to fit every contour of the typewriter snugly. This holds the machine firmly in place while the expanded polystyrene soaks up shock and impact during transfer. After the packer sets the machine in the lower half of the pack, he places the upper half over it, binds the halves together with steel bands. The typewriter is not bolted down, strapped, or padded.



Cuts Steel Like Soft Butter

Cutting billets gets off to a flying start with this highly effective flame-cutter at Pittsburgh Steel Company, Allenport, Pa. The addition of special Oxweld iron powder to the oxygen cutting flame boosts output and slashes production costs. Output of the entirely automatic operation is better than 1000 billets every eight-hour shift.

Cuts are clean and sharp, require no finishing. Billets range to 7½ inches in diameter, are sliced into lengths from 4 to 12 feet whether the material is mild or high-carbon steel. Next billets go into seamless tube hot mills.

In replacing shears with powder cutting, Pittsburgh Steel also prevents elliptical shaped ends. The two Oxweld C-39 cutting torches (Linde Company, New York) with powder-cutting attachments are mounted on an Oxweld CM-37 machine carriage that automatically controls cutting speed. Cams ride over the surface of the billets, thus raising and lowering the torches to follow the contoured surface. Addition of powder from pneumatic powder dispenser produces the intense reaction. The operator easily and accurately controls the machine from a nearby control booth.

Suggesters Win Company Stock

Cost-cutting ideas produce shares of company stock for employees of American Bosch Arma Corporation (Hempstead, N. Y.). And what better way to dramatize the relationship between better operations and the value of the company's shares? Here's how the plan works:

- Savings for the first year the suggestion is in effect are calculated. The suggester gets 10% of the total for his award.
- The award amount is divided by the current value of the company's stock on the New York Stock Exchange. This determines the number of shares to be given in the award. For example, assume the award value is $400 and the present stock price is $40 per share. That gives the suggester an even 10 shares for his award.
- Fractional shares are paid in cash. In the example, if the award had been calculated at $420, the suggester would have received $20 cash plus his 10 shares.

Of course, employees may keep their shares of stock or sell them as they choose.

STANDARDIZED CARTONS CUT COSTS, DAMAGE.

DESK ON WHEELS SAVES TIME, ERRORS.

MOBILE RACKS CAN BE STACKED, TOO.

Little Tricks Make Operation Smoother

If you've spent millions for a modern warehouse, don't think you can sit back and push buttons to make everything work perfectly. Not even if it's equipped with the latest storage and handling equipment along with electronic computers to control and prepare shipping orders. This may take care of the big problems. But little refinements are needed too, to cut costs, eliminate details, and add polish to the operations.

Clark Equipment Company recently put such a warehouse into operation in Chicago to stock replacement parts for dealers and customers of its four Michigan manufacturing divisions. Here Clark stocks over 4½-million parts in a 6-acre building. These big figures mean big headaches if everything doesn't run smooth and fast. To insure this Clark came up with several interesting ideas. No one of them would affect warehousing tremendously. But their collective impact is impressive. For example, here are three that could help any warehouseman cut costs.

Standardization of cartons for shipping orders reduces packing and strapping costs. Also, makes for more uniform pallet loads. To ship thousands of parts on hundreds of orders each day, Clark uses only four different size cartons and three different size pallets. But the four cartons and three pallets have definite dimension relationships that permit uniform stacking and faster strapping. Result is neat, compact loads.

Clark warehousemen say actual carton and pallet dimensions aren't important. It's their relationship that counts. For example, the smallest carton measures H x L x W in height, length and width. (Actual inside dimensions are 10 by 19 by 19 inches.) The next size measure 2H x L x W; the third, H x 2L x W; and the fourth carton 2H x 2L x W. Pallet faces measure L x W, 2L x W, and 2L x 2W.

This carton-pallet relationship permits the formation of modular pallet loads from one or several cartons strapped evenly and compactly to the appropriate size shipping pallet. Cartons are flush with pallet deck and edges. Thus there are no carton overhangs to get damaged or no small packages to be lost because of loose bands.

But Clark didn't stop improving packing techniques. To further speed up and improve the quality of packing inside the carton, Clark devised a series of inexpensive "no-strength" corrugated boxes and slip sheets (photo, left). These inner cartons are also modular in size, have a definite relationship with shipping container sizes. These modular boxes hold small parts, keep fragile items, prepacks, and heavier items separated. This prevents parts from shifting inside carton while in transit and damaging one another. It's responsible for the drop in customer complaints.

Mobile "office" on the shipping floor (upper right) saves valuable man-hours for traffic clerks. And the caster-mounted units are low cost, too. They cost roughly $20 each to make from inexpensive and salvaged materials.

Purpose of the mobile work centers is to eliminate walking be-

tween the shipping floor and traffic office to prepare bills of lading for the hundreds of orders going out daily. But also improved is order accountability. Now there's much less chance of misrouting shipments because shipping orders were separated from actual packages.

As a result of moving the work to the material, traffic clerks complete all the necessary shipping forms and tags right at the point-of-use. They just wheel the desks alongside the package and do the paperwork.

Stacked racks on wheels bring lumber directly from the truck dock or rail siding to the carpenter shop. Then the same nine units are stacked three high for efficient storage (lower right). The lumber is used to pre-crate many heavy and bulky parts prior to storage and for special export shipment crates.

Lumber comes in either by truck or by rail in 1500-board-foot bundles. A fork truck unloads the bundles and places them in the mobile storage racks (Equipment Manufacturing, Inc., Detroit). Loaded racks are then towed to the pre-crate area and stacked immediately adjacent to the saws so boards can be easily withdrawn as needed.

Source: Lawrence E. McCoy, Warehouse Manager, Central Parts Div., Clark Equipment Company, Chicago.

Puts Switches In Open View

Now anyone can find out if disconnect switches are open at E. I. du-Pont de Nemours' Edgemoor (Del.) plant. Safety rules have always required electricians to open these switches before they work on 440-volt lines. The trouble was, switches are enclosed in locked steel cabinets. Thus no one else knew whether they were disconnected or connected. With the addition of glass panels, anyone interested can see position of switches. This eliminates the need of hunting for the electrician to get the answer. Installation cost of windows was $80 per switch. But they're worth it as safety measure—and as a time saver as well.

New Salvage Idea Speeds Tooling

How do you tool up for a missile component in 10 days when patterns can't be ready for at least six weeks? That was the problem Ryan Aeronautical Company (San Diego) had to solve. Solution came by using structural metal-to-metal adhesives to salvage once-discarded scrap tooling metal. And now Ryan saves upwards of $20,000 annually in tooling costs. Here's what happened:

About a year ago Ryan had to produce molded fiberglass shells for wing-tip radomes of drone targets under heavy time pressure. To get the 4-ft. male mold would cost $600, require a six-week wait.

That's when the Ryan engineers conceived the idea of building the tooling molds in much the same way wooden blocks are glued together to construct a forming block. But instead of wooden blocks, scrap pieces of cast aluminum tooling metal were bonded together. Structural aircraft adhesive used was Narmco Metlbond 4041 (Narmco Resins & Coatings Co., Costa Mesa, Calif.).

Ten days later Ryan had its mold and the first Firebee radome. Now Ryan salvages scrap aluminum tooling metal with this technique, roughsaws and bonds scrap metal together to form blocks of the right size, then machines them to shape.

Adhesive costs run about $200 a year while savings top $20,000. To prepare metal surfaces for bonding they're cleaned first with a methyl-ethyl-ketone wipe. Next follows an alkaline cleansing and a water rinse. Then surfaces are ready for application of the adhesive and curing at 350 F. at 100 psi. for an hour.

How strong are the bonds? Ryan's tool engineers report that they've never torn a bond apart regardless of the severity of the cut made during machining.

Motor Juggling Saves the Day

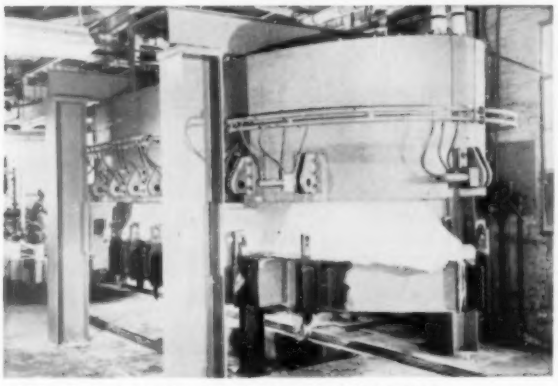
Took only three weeks for Granite City Steel Company (Granite City, Ill.) to boost cold strip mill tonnage 40%, increase the range of sheet gages that could be run at full speed, and improve control. And in the changeover, only one 1500-hp. drive motor was removed from service. Every other motor and generator was reused in the new set-up.

Motor-generator juggling was the key. It's a clear demonstration of how the latest control systems and more power can update a mill if the electrical and mechanical components are in good shape. Formerly the four-stand mill and delivery reel used five motors supported by a 12,000-hp. motor generator set with five generators. Working closely with the equipment designers (Allis-Chalmers Manufacturing Company, Milwaukee), Granite City engineers worked out a method of using every generator and motor (except one 1500-hp. unit) in the new system. They did this by paralleling existing equipment and shifting some units to a concurrent temper mill modernization project. In addition, one new 1200-hp. delivery reel motor along with a four-unit motor-generator set were added.

Contributions from readers reporting experiences will be welcomed. No need for fancy writing; just a clear, concise statement of facts. If you have photos or drawings, be sure to include. We'll edit for the Case Book. Contributions accepted will be paid for at time of publication. Address: Case Book Editor, FACTORY, 330 West 42nd St., New York 36.

FIRST, A BUILD-UP OF GLASS FIBERS . . .

THEN A SPRAY OF RESIN . . .



AND THE HULL'S READY FOR MOLDING.

RESULT: A HULL IN FIVE MAN-HOURS.

Makes Boat Building Look Easy

Pressure bag molding isn't a brand new plastic fabrication method. But it is an interesting one. It's proving economical in the mass production of 15-ft. reinforced plastic boat hulls at the Winner Manufacturing Company (Trenton, N. J.). And one of the biggest pluses is the reduced man-hours required to produce each unit. Takes only five man-hours of work per hull.

The four pictures above show some of the important steps in the process. For more on the details look at the photos above, read the text below.

1. Boat hulls start to take form with the placement of a mat of glass fibers over a supported rubber bladder. In positive pressure bag molding the bladder serves as the form (and male half of the mold) for the inside of the hull during molding. The bladder in an inverted position is first covered with a parting film of polyvinyl alcohol to prevent the laminate from sticking. Glass fibers reinforce the resin, which is sprayed on the build-up next.

To get maximum use of the single-heated, precision-machined female mold, Winner has two build-up forms. Each is on a track-mounted shuttle car. Thus while one hull is being cured on one form, workers are stripping a finished hull and starting to build up a new one on the second form.

2. Build-up continues as layers of fiberglass mat are added to the form, then sprayed with a predetermined amount of resin. Wooden stiffeners laid along the length of the hull provide extra strength. Then these supports are covered with fiber glass and resin so the entire hull becomes a single unit prior to molding. Further strengthening of various critical hull areas is accomplished by the addition of still more layers of fiberglass.

Note the heavy-duty transom of 1¾-in. thick plywood that is already in place. After it has been sandwiched between layers to fiber glass and resin it becomes an integral part of the hull. This sure-fire method of construction insures that the transom will stand up under the beating from powerful motors that are in use today.

3. Up goes the carriage carrying the rubber bladder and hull build-up into the female mold. A hydraulic jack raises the carriage off the floor until contact is made with the fixed portion of the mold. Then it's locked in place while heavy pressure, adding up to some 300 tons, is applied through the bladder. The curing cycle takes 30 minutes at moderate temperature (180 F).

Electrical tapes connected to the inside of the bladder assure proper curing of the hull interior. At the same time, the steam chested female mold provides a rapid cure for the exterior surface. The combination

tween the shipping floor and traffic office to prepare bills of lading for the hundreds of orders going out daily. But also improved is order accountability. Now there's much less chance of misrouting shipments because shipping orders were separated from actual packages.

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About a year ago Ryan had to produce molded fiberglass shells for wing-tip radomes of drone targets under heavy time pressure. To get the 4-ft. male mold would cost $600, require a six-week wait.

That's when the Ryan engineers conceived the idea of building the tooling molds in much the same way wooden blocks are glued together to construct a forming block. But instead of wooden blocks, scrap pieces of cast aluminum tooling metal were bonded together. Structural aircraft adhesive used was Narmco Metlbond 4041 (Narmco Resins & Coatings Co., Costa Mesa, Calif.).

Ten days later Ryan had its mold and the first Firebee radome. Now Ryan salvages scrap aluminum tooling metal with this technique, roughsaws and bonds scrap metal together to form blocks of the right size, then machines them to shape.

Adhesive costs run about $200 a year while savings top $20,000. To prepare metal surfaces for bonding they're cleaned first with a methyl-ethyl-ketone wipe. Next follows an alkaline cleansing and a water rinse. Then surfaces are ready for application of the adhesive and curing at 350 F. at 100 psi. for an hour.

How strong are the bonds? Ryan's tool engineers report that they've never torn a bond apart regardless of the severity of the cut made during machining.

Motor Juggling Saves the Day

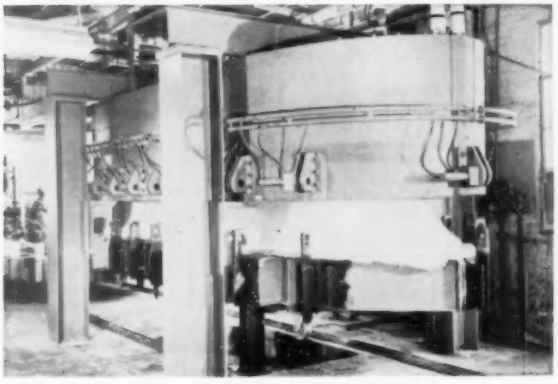
Took only three weeks for Granite City Steel Company (Granite City, Ill.) to boost cold strip mill tonnage 40%, increase the range of sheet gages that could be run at full speed, and improve control. And in the changeover, only one 1500-hp. drive motor was removed from service. Every other motor and generator was reused in the new set-up.

Motor-generator juggling was the key. It's a clear demonstration of how the latest control systems and more power can update a mill if the electrical and mechanical components are in good shape. Formerly the four-stand mill and delivery reel used five motors supported by a 12,000-hp. motor generator set with five generators. Working closely with the equipment designers (Allis-Chalmers Manufacturing Company, Milwaukee), Granite City engineers worked out a method of using every generator and motor (except one 1500-hp. unit) in the new system. They did this by paralleling existing equipment and shifting some units to a concurrent temper mill modernization project. In addition, one new 1200-hp. delivery reel motor along with a four-unit motor-generator set were added.

Contributions from readers reporting experiences will be welcomed. No need for fancy writing; just a clear, concise statement of facts. If you have photos or drawings, be sure to include. We'll edit for the Case Book. Contributions accepted will be paid for at time of publication. Address: Case Book Editor, FACTORY, 330 West 42nd St., New York 36.

FIRST, A BUILD-UP OF GLASS FIBERS . . .

THEN A SPRAY OF RESIN . . .



AND THE HULL'S READY FOR MOLDING.

RESULT: A HULL IN FIVE MAN-HOURS.

Makes Boat Building Look Easy

Pressure bag molding isn't a brand new plastic fabrication method. But it is an interesting one. It's proving economical in the mass production of 15-ft. reinforced plastic boat hulls at the Winner Manufacturing Company (Trenton, N. J.). And one of the biggest pluses is the reduced man-hours required to produce each unit. Takes only five man-hours of work per hull.

The four pictures above show some of the important steps in the process. For more on the details look at the photos above, read the text below.

1. Boat hulls start to take form with the placement of a mat of glass fibers over a supported rubber bladder. In positive pressure bag molding the bladder serves as the form (and male half of the mold) for the inside of the hull during molding. The bladder in an inverted position is first covered with a parting film of polyvinyl alcohol to prevent the laminate from sticking. Glass fibers reinforce the resin, which is sprayed on the build-up next.

To get maximum use of the single-heated, precision-machined female mold, Winner has two build-up forms. Each is on a track-mounted shuttle car. Thus while one hull is being cured on one form, workers are stripping a finished hull and starting to build up a new one on the second form.

2. Build-up continues as layers of fiberglass mat are added to the form, then sprayed with a predetermined amount of resin. Wooden stiffeners laid along the length of the hull provide extra strength. Then these supports are covered with fiber glass and resin so the entire hull becomes a single unit prior to molding. Further strengthening of various critical hull areas is accomplished by the addition of still more layers of fiberglass.

Note the heavy-duty transom of 1¾-in. thick plywood that is already in place. After it has been sandwiched between layers to fiber glass and resin it becomes an integral part of the hull. This sure-fire method of construction insures that the transom will stand up under the beating from powerful motors that are in use today.

3. Up goes the carriage carrying the rubber bladder and hull build-up into the female mold. A hydraulic jack raises the carriage off the floor until contact is made with the fixed portion of the mold. Then it's locked in place while heavy pressure, adding up to some 300 tons, is applied through the bladder. The curing cycle takes 30 minutes at moderate temperature (180 F).

Electrical tapes connected to the inside of the bladder assure proper curing of the hull interior. At the same time, the steam chested female mold provides a rapid cure for the exterior surface. The combination

of pressure and heat produces a hardened, one-piece hull. The hull is now finished, requires no further processing.

4. As completed units emerge from the mold, they can be handled without damage or warpage since they're fully cured. The first steps in assembling accessories like seats then take place. With the addition of other reinforced plastic parts molded separately, the upper structure of the boat starts to take form and the 15-footer is well on its way to completion.

One Man Now Replaces Three

This automatic length measurer is a dream come true. It relieves two men of a tedious, difficult pipe-measuring job. It's used at Pacific Tube Company (Los Angeles) to measure stainless steel pipe accurately. Before the installation of this system one man held the tape at one end of the pipe while another measured the length at the other end. A third man wrote down the lengths called off. Then a fourth in the office transcribed the notes to a typewritten form.

The new method is fast, accurate, simple. The tubing to be measured rolls out on an inspection table and butts against a fixed end stop. The operator then places the end of a small control handle against the other end of the tubing. When a "Record" button on the handle is pressed, the pipe length is instantly recorded in feet and inches on an adding machine.

What if Pacific Tube wants a total? The man just presses a "Total" button. The operator can take two readings per second because the measuring cable can be moved immediately after the "Record" button is pushed. The adding machine takes only 0.3 seconds to catch its breath between readouts. The system, constructed by Datex Corporation (Monrovia, Calif.), consists of an encoder assembly, a control unit, and a data log.

Shuffled Lineup Smooths Operation

Want to streamline your production ordering and shop loading operations? Then you'll be interested in what the Nortronics Division of Northrop Aircraft, Inc. (Hawthorne, Calif.) has done. Northrop shuffled its organization to give more machine loading responsibility to line departments. Also, Northrop merged functions to reduce duplication of effort, cut paperwork. Here's how the new organization set-up compares with the old:

Old way was not unusual for this type of operation. Production engineering, production planning and production control were separate departments. Production orders and machine loading schedules originated in the production control department, were routed through planning and production engineering on their way to the factory. Reason for the routing: Planning and production engineering need order information for their records.

New way is streamlined, involves the following three changes:

1. Planning has moved into the framework of the production engineering department. This simplifies collection of vital information necessary to both functions, reduces duplication of effort.

2. Planning now prepares production orders. And as planning is part of production engineering, all old routing of production orders is eliminated. Now one department (production engineering) handles all paperwork up to the point of release to the factory.

3. Shop (machine and process) loading is handled by line departments in the factory. Leveling of work loads is the responsibility of operating department heads. Because these line men know their operations better than staff men, they're able to increase productivity and reduce costs, operating men at Nortronics say.

Paper Separators Cut Warehouse Cost

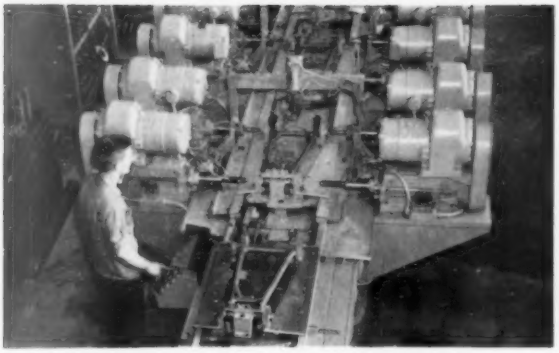
Simple paper separators are saving customers of Rolled Steel Corporation (Skokie, Ill.) labor man-hours and material cost, eliminating the traditional 2x4 lumber separators used during shipment.

Each paper label lists gage and size of each lot, also makes it easy for customers to separate like sheets in short order. The paper separators are printed inexpensively in Rolled Steel's own print shop, are marked by operators for size and gage.

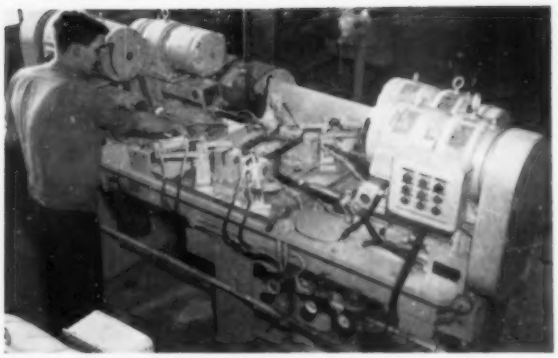
Newest Phone Dialing System

The nation's first industrial direct-dialing telephone system enables outsiders (including customers) to dial directly to any phone inside the plant of Dow Chemical Company (Midland, Mich.). Conversely, Dow personnel can dial long-distance, station-to-station calls without talking to an operator. Only hitch: The number being called must be some area of the country that has direct-dialing equipment.

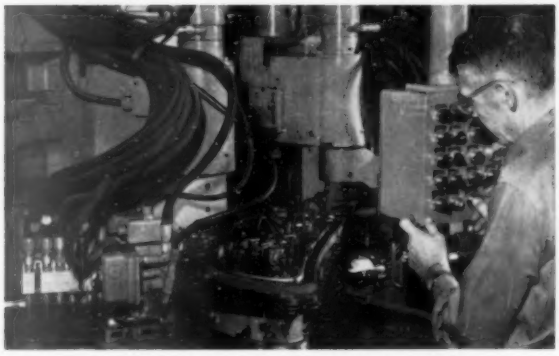
No operator is needed to complete calls in either direction. Calls are recorded on punched tapes for billing purposes. All direct-dialing phones inside the plant will have individual two-letter exchange plus five-digit phone numbers similar to standard phones. No extension numbers are used, although all phones have a common exchange and first-digit designation. Naturally, incoming calls not directed to a specific phone will continue to go through Dow's central operators.



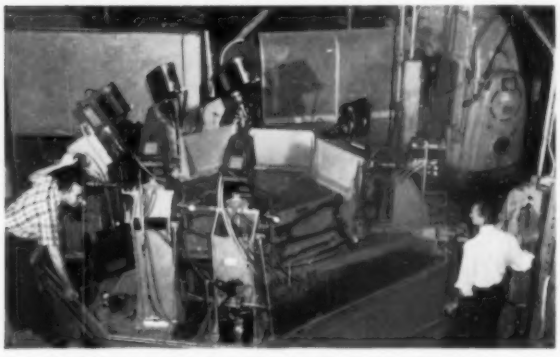
1. THREE-STATION DRILL BOOSTS QUALITY.



3. TWO MACHINES TEAM UP TO LIFT OUTPUT.



2. SPECIAL PROFILE FIXTURE SAVES TOOLS.



4. EIGHT-STATION INDEX SAVES MANPOWER.

Tailored Tools Tame Tough Tasks

The special tools in the photos above are all hard at work making aircraft parts for the F-102A supersonic interceptor at Convair Division of General Dynamics Corporation, San Diego. Tolerances are tight. And there's plenty of pressure to produce good pieces. To do this, the company's manufacturing engineers have to find ingenious solutions to solve peculiar fabricating problems. Here are four examples:

1. This three-station semi-automatic fixture cuts rejects by 75%, saves 114 minutes on every part produced. Work formerly was done on a standard radial drill, using trunnion-type fixtures. Required five operations to machine each hole.

Now separate heads do the rough drilling, the reaming, and the tapping operations. A hydraulic ram moves parts to each successive machining position. Spray mist coolant for all operations is supplied from a central reservoir.

2. Special profile fixture contour trims air scoop frames. Old way was to scribe each part from a master shell, saw off excess stock, then grind to scribe lines. Since part is made of 410 stainless steel, cost of saw blades was a problem. New profile milling method eliminates saws, cuts machining time by 30 minutes per part.

Here's how it works: Two three-dimensional trace valves automatically position and motivate two hydraulic milling spindles mounted to an overhead bridge. Specially designed table rotates the workpiece through its cutting cycle while air clamps hold part in place. Ten of the clamps are rigged to open and close. This allows cutters to bypass clamping positions. Removable master cams permit the fixture to accommodate four different models of the part.

3. Shown above is half of a two-unit semi-automatic fixture. It—and its counterpart—increased production by 50 parts per hour, cut rejections 60% in drilling and reaming the forked ends of a weldment. Alignment of the holes is critical. Formerly operations were done in a radial drill press. Three tool changes were required and the holding fixture had to be indexed for machining each side. Now all four holes are drilled in one pass. Then the part is transferred to the second unit, where reaming of holes completes the cycle. Parts are secured by air clamps.

4. Eight stations involving 16 drilling and tapping units do the work at this machine. Designed by Convair tool engineers and built by Aircraft Standards (Santa Monica, Calif.), it replaces laborious single-hole drilling on standard drill presses. Results include increased production, increased tap life by (100%), reduced man-hours.

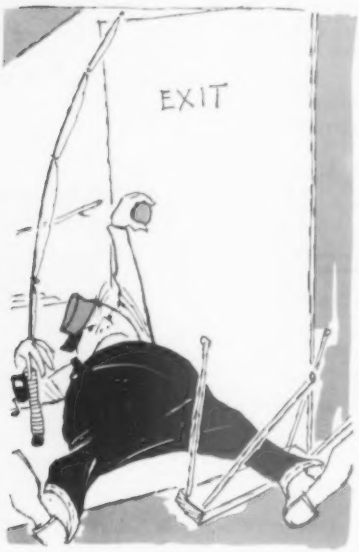
The machine's 12-ft. octagonal frame supports a 60-in. indexing table. Seven holding fixtures capable of securing six different parts at once are mounted around the periphery of the table. Drilling and tapping units feed in at a 30-deg. angle. Indexing takes 4 seconds, machining roughly 50 seconds. And the units will not operate if a station is empty.

YOU BE THE ARBITRATOR

THE CASE OF

The Compensable Accident

Out of the experience of the American Arbitration Association



When the management of a furniture company and its union negotiated a collective bargaining contract, they agreed the vacation pay a worker could draw would be based on the hours worked in the two weeks immediately preceding the vacation period. Furthermore, time lost because of "compensable injury" was to be counted as time worked in the pay computations.

All seemed clear until a week before the vacation period started. Then Edward S. tripped over a work horse, injuring his chest and shoulders. He was treated by a Workmen's Compensation doctor and was paid for the day the accident occurred. But Ed lost another full day before he returned to work. Thus management figured that Ed worked only 32 hours in the week preceding vacation and paid him accordingly. Result: The union filed a grievance.

"That was a compensable injury and Ed is entitled to a full week's vacation pay," argued the union steward.

"Not so," answered the company. "That injury didn't last long enough to be compensable under our state compensation laws. So we don't have to count the lost day as though it were time worked for vacation purposes."

Eventually the case went to arbitration. Suppose you were the arbitrator. How would you rule?

For the actual decision turn to page 128

What Effects From Incentive Pay?

• Employee earnings in 2500 companies representing 29 industries increased an average of 20.6%.

• Labor savings for the companies involved averaged roughly 25%.

• And productivity increases averaged 63.5%.

All this was due to the installation of incentive programs, says John D. Dale, president, the George Elliott Co., Inc. Dale bases his conclusions on a 1958 survey of 17 management consulting firms who reported on plans they had installed. Of the total plans included in the survey, 77% were installed after the end of World War II.

Broken down further, averages show for every 1% increase in wages earned by workers, aggregate companies increased productivity by 3.1%, at the same time reduced their unit labor costs 1.25%. "Thus," Dale adds, "wage incentives are the best hedge against inflationary wage increases that are often granted without regard to productivity increase."

To avoid extreme values in overall averages, surveyors weighted final results by eliminating the top and bottom 25% of the cases reported. If extremes had been included, there would have been big distortions in increased productivity, increased earning, and decreased costs. Dale explains this by citing the marked improvement even in lower extremes. Reason for selecting management consulting firms to survey instead of individual companies was to eliminate the home-made plans that are often miscalled wage incentives by individual firms. All plans included are considered "professionally installed" and use time studies or predetermined time systems as a basis for work measurement. Furthermore, all incentive bonuses are being paid for extra productivity above what management consulting firms call "standard performance."

Special Conveyor Speeds Assembly

The diamond plate catwalk running through the center of the 150-ft. final assembly line makes life a lot safer and easier for production workers. Lets them safely mount the conveyor to complete certain operations in final assembly at Thatcher Furnace Company (Garwood, N. J.).

The new conveyor (designed by Thatcher) replaces a pallet-type device. A furnace had to be placed on a steel pallet, then pushed along. This was arduous, time-consuming.

Now movement of the heavy units is many times easier. The base of the furnace packing crate is the pallet. It normally travels on a double row of 6-in. horizontal ball-bearing rollers. Five ball transfer stations placed at 12-ft. intervals along the run facilitate shunting to spur lines flanking each transfer station. On these lines workers perform additional assembly on furnaces without interrupting their normal assembly operations.

Reprints of the Plant Operating Case Book are available. Price 50¢. For quantity prices write Reader Service Department, FACTORY, 330 W. 42nd St., New York 36.

Gets Materials In Faster

Electronic transmission of handwritten messages has modernized receiving-department paperwork at Pesco Products Division of Borg-Warner Corporation. In addition to getting vital information to all points in hours instead of days, it also . . .

. . . *Gives Pesco $15,000 worth* of valuable floor space because materials move in and out of receiving area faster.

. . . *Saves $1100 annually* in cost of forms through simplification and elimination.

. . . *Cuts labor requirements* 1000 man-hours annually by eliminating typing and posting operations.

Streamlining paperwork takes bookkeeping and typing jobs out of receiving, puts an end to incoming material pile-ups. A network of transceivers and receivers (TelAutograph Corporation, Los Angeles) lets receiving clerks write move tickets for incoming material at the rate of 2500 per month. Simultaneously similar tickets are automatically printed at any or all of four other departments in the hook-up. Receivers are installed in the departments of accounting, manufacturing engineering, production control, and product engineering.

Set-up works like this. As a shipment reaches receiving, necessary information on the packing slip is put on the transceiver form. Selector panel keys let the operator route messages to right destinations (photo). Forms in the transceiver are prenumbered. But the clerk repeats this number on each form by hand to provide a cross-referenced control for each department.

Purchase-order code on incoming packing slips determines where material goes. Seconds after a form is filled out, it's torn off and attached to the shipment to serve as a move ticket. Meantime receivers of the forms obtain the following information faster:

- Accounting gets copies of all incoming material tickets, uses them as authority to pay invoices. This helps Pesco take advantage of short-term discounts.
- Manufacturing engineering finds out sooner when new tooling arrives.
- Production control similarly gets to know about incoming production items more promptly. This saves on follow-up by phone and telegram, results in a speed-up of the entire manufacturing process.
- Product engineering receives nearly 25% of the forms advising engineers working on "hot" experimental projects needed items have arrived.

Source: Joseph W. Nowak, Supervisor, Traffic & Shop Manufacturing Control, Pesco Products Division, Borg-Warner Corp., Bedford, Ohio.

CASE BOOK CAPSULES

Caster mounting a conventional tank compressor lets the Commercial Metal Spinning Company of Toledo service many jigs and fixtures in different locations with a single unit. CMS just plugs in the DeVilbiss compressor and it's ready for use.

Unipro microfilm processor handles 100 feet of film in 29 minutes. According to Remington Rand, Division of Sperry Rand (New York), it processes 16-, 35-, and 70mm microfilm continuously or intermixed without adjustment or special attachments.

New formula to tell how much money an industrial firm can profitably spend on research and development is under development as part of a long-term study at Case Institute of Technology, Cleveland. Results are expected to be available late this year.

Photographs in total darkness can be made with an infra-red device developed by the Army Engineer's Laboratories (Ft. Belvoir). The Thermograph (Barnes Engineering Company, Stamford, Conn.) depends on "heat" or infra-red radiation to produce an image.

"Fuel cell" in final development at Lockheed Missile Systems Division, Sunnyvale, Calif., converts chemical energy directly to electrical. Lab tests have achieved almost 100% "fuel" utilization and energy-conversion efficiency of over 70%.

Boost of 10 to 20% in mill efficiency is possible with "Electric Ear" feed control and observation units, says the designer, Hardinge Company (York, Pa.). Permits automatic capacity control and continuous observation of grinding mill performance.

Snort valve silencer eliminates noise on blast furnaces at Kaiser Steel, Fontana, Calif. The 8000-lb. device (Koppers Company, Baltimore) proved its efficiency in recent tests.

RACK SAVES AIR SPACE AND PACKERS' TIME

Packers never want for assembled wire bound boxes at Owatonna Tool Company (Owatonna, Minn.). The reason is this self-service gallery built between the top of metal storage racks and the plant ceiling. It provides enough room to hold a goodly supply of 22 different sizes of wirebound boxes that Owatonna uses to pack a wide variety of tools for shipment. Flattened wirebound blanks of the boxes are high-stacked on a series of roller conveyors, move forward as needed. Assembled boxes are then placed within easy reach of packers.

Company Makes Good Credit Union's Loss

The credit union treasurer at John Deere Plow Works in Moline, Ill., embezzled the funds. Investigators figure the total loss may top $100,000. The credit union, like most, is independent of the company. Thus the company doesn't choose the officers or participate in the investment, auditing procedures, or other credit union affairs.

But John Deere will make up the losses. Why? So the credit union can resume operations. And so company employees will not suffer financial loss because of the treasurer's wrongdoing.

What's the point? Just this: If you have a credit union, its funds could be embezzled, too. And chances are your company would feel responsible—even though it doesn't control the credit union. So why not take a more active part in your credit union's operation? John Deere plans to in the future. Will make sure that the newly funded credit union has deposit insurance, surety bonds, and an auditing procedure that will make future losses impossible.

Why don t you check these points in your plant, too?

Ten Cameras Watch 43 Truck Docks

Closed-circuit television substitutes for management's direct observation at Yale Transport Corporation's New York City multi-bay truck dock. Ten TV cameras are spotted throughout the terminal (which services up to 800 trucks daily).

Receivers show exactly what's going on in the terminal's new operations offices 250 feet away. The system (Dage Television Division, Thompson Ramo Wooldridge, Inc., Michigan City, Ind.) has increased the number of trucks the terminal can handle daily by cutting minutes from the average time a trailer sits at the dock.

Here's how the system works: Ten automatic TV cameras are secured to beams above the loading and storage areas. Each of nine cameras covers from four to eight of the terminal's 43 truck bays. The operations office dispatcher remotely controls the tenth (central) camera. He can point it in any direction, select any of four lenses to get a close-up view of areas not completely covered by the fixed cameras.

The dispatcher (photo) now just glances at the monitor screens for a complete picture of loading and unloading. Using two-way radio he directs incoming drivers to selected bays. And the system aids guards during off hours. Another plus: The TV system eliminates a 500-sq. ft. glassed-in office located inconveniently in the center of the dock area.

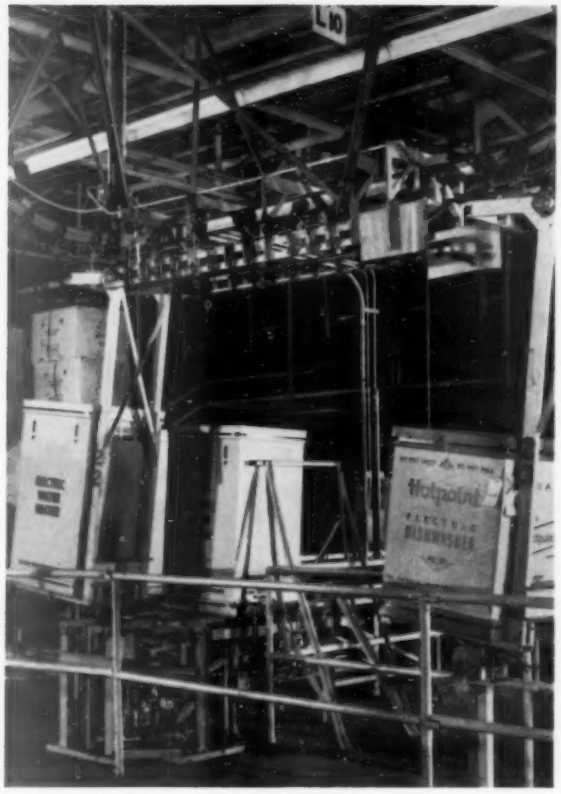
Repairs Don't Stop Production

Making repairs on buildings without interfering with production is a problem the Continental Paper Company (Ridgefield Park, N. J.) faced and solved. Eight concrete roof beams adjacent to ventilators in the boiler house had cracked and spalled at the surface because of moisture absorption. As concrete fell off, high humidity within the plant rusted the exposed reinforcing steel. The rust in turn expanded as it formed, thus further cracking off large pieces of concrete. In addition, constant vibration of heavy machinery speeded disintegration.

With "fast-setting" chemicals added to the concrete, repairing the eight beams took only two days instead of the two weeks estimated for conventional methods. And there was no downtime while the 25-ft. high ceiling was repaired. Here's how the job progressed:

First, workmen removed loose and disintegrated concrete with air-operated chipping hammers. Then they wire-brushed exposed reinforcing to remove rust. On all areas where the depth of repair was more than one inch, wire mesh was tied to the reinforcing steel and fastened to the concrete.

The mix used to finish the job consisted of one part cement and three parts sand, plus additives to accelerate the setting and improve the bonding (Sika Chemical Corporation, Passaic, N. J.).



1. PICKS 'EM UP AT PRODUCTION.

2. SETS 'EM DOWN IN THE WAREHOUSE.

3. THEN SHUTTLES 'EM TO STORAGE.

Here's Really Automatic Handling

Moving appliances from production line to warehouse can be a pretty tiresome job. And it can require a lot of man-hours, too. But not the way it's set up at the Hotpoint Company's Milwaukee plant. Here electric water heaters and dishwashers move from packaging lines to warehouse untouched by human hands. That's why you don't see any people in the three pictures above. There's no need for them. The entire operation is conveyorized.

Heart of the mechanized handling operation is a 100-ft. closed-loop overhead conveyor with forks every 10 feet. Moving at speeds from 30 to 60 fpm., this unit dips down at heater and dishwasher packaging lines and picks up waiting units. And there's never any jam-up, either. Why? Because tiny limit switches make sure everything comes out even.

The conveyor makes its first pick-up at the dishwasher line, its second at the water heater line. Gravity conveyors bring units from packing to the pick-up area. Photo at left shows a heater just being picked up while a second one is in the ready position. But this second water heater will not be transferred to the pick-up station until an empty fork carrier is in sight. Since the next carrier on the line already has a dishwasher aboard, the next heater in line stays where it is. Reason: the dishwasher carton has tripped a limit switch. This prevents the transfer ram mechanism from pushing the next unit onto the pick-up platform inadvertently.

When an empty fork carrier comes along, a pneumatically operated ram moves a unit to the pick-up station. During this transfer appliances move roughly 36 inches. While the ram is in the forward position a mechanical brake on the roller conveyor prevents the next unit from moving into the transfer slot. But when the transfer ram retracts, it trips a limit switch releasing the brake. Meanwhile, a second limit switch regulates the ram stroke so it centers different size cartons properly on the pick-up platform. For added safety, an overhead cam prevents conveyor runaway in the event a link breaks.

Water heaters and dishwashers are unloaded automatically at a common station when they reach the warehouse (upper right photo). The overhead conveyor drops at a 40-deg. angle, levels off just prior to the unloading station. As a carrier enters the take-off station its forks enter guide slots in a 25-ft. floor-mounted, slat conveyor. This unit is built so it rises roughly 4 inches higher than the forks. Thus the conveyor removes appliances from overhead carriers. Since the take-off conveyor moves twice as fast as the overhead one, the appliance moves away from the forks before reaching the end of this unit. Next water heaters and dishwashers move onto a 40-ft. gravity roller conveyor. The carriers make an 180-deg. turn and head back to the pick-up stations.

In the warehouse, like units are

separated for storage (lower right photo). Water heaters go to the left, dishwashers to the right. This switching, too, is fully automatic. A 10-ft. power belt conveyor brings cartoned appliances to this transfer station from the gravity conveyor. As the cartons slide off the end of the belt, they trip the limit switch arms.

If the top arm is moved, this means the next unit is a water heater and the roller conveyor spur is moved to the left by a double-acting air cylinder. If the top arm is not deflected, the unit is a dishwasher and goes to the right (lower right photo). Additional limit switches operate stops in the conveyors to prevent misrouting and jams. From the end of conveyor spurs fork trucks equipped with special handling attachments take units two at a time to their exact storage location.

Down With Those Clean-Up Costs

This big trash can knocks out 60% of the cost of keeping this outside employee dining area clean at the San Diego plant of Convair Division of General Dynamics Corporation. One catch: System works well only in a large-volume trash-generating area easily accessible to a truck. This installation measures up.

Formerly 12 to 18 trashbaskets were scattered throughout the area. Two men and a truck cleaned these units out every morning by hand. Now one man with a Dempster-Dumpster (Dempster Brothers, Inc., Knoxville, Tenn.) drives into the area twice a week, hoists the container on his truck, empties it, then returns it. Idea came from Convair's successful use of the Dumpster system for sawdust removal at the wood mill and model shop.

Floats the Jigs Right Into Place

The man is moving a heavy drill jig from one station to the next on a tiny cushion of air. He's making pump casings, frames, and suction covers for Taco Heaters, Inc. (Cranston, R. I.). Parts weigh about 50 pounds each, jig another 150. But the operator makes the transfer with little effort, thanks to the Floating Plate (Centerline Engineering Company, Wethersfield, Conn.).

Taco estimates savings of 15% on the operation over the old way of manually moving the jig from one station to the next on progressive drilling operations. Normally a jig of this size is moved on rollers or balls fastened either to the drill table or the bottom of the jig. But this method has some major drawbacks. Rollers get clogged with chips, won't roll. And if the rollers move too freely, the jig shifts around during drilling.

The Floating Plate overcomes each difficulty. First, there's nothing to become clogged. Second, during drilling, the plate sits solidly on the drill table (as the air is cut off). Third, because the air pressure is applied whenever the jig moves, all the chips get blown away in the process.

The Floating Plate has a normally closed pushbutton valve that's connected to existing air lines with a hose. When the operator depresses the valve, air flows through passages within the cast-iron plate and out through ports in the bottom. This exerts a lifting force against the press table, lifts the set-up a few thousandths of an inch on a cushion of air until it is positioned properly. Releasing the valve shuts off the pressure and allows machining under rigid conditions.

YOU BE THE ARBITRATOR

Continued from page 124

The award—Ed got his vacation pay computed over again to include the lost day. The arbitrator said "compensable injury" referred to the manner in which the injury occurred, not to whether it was of sufficient duration to result in payments by the state. Furthermore, he said, medical treatment is also a form of compensation.

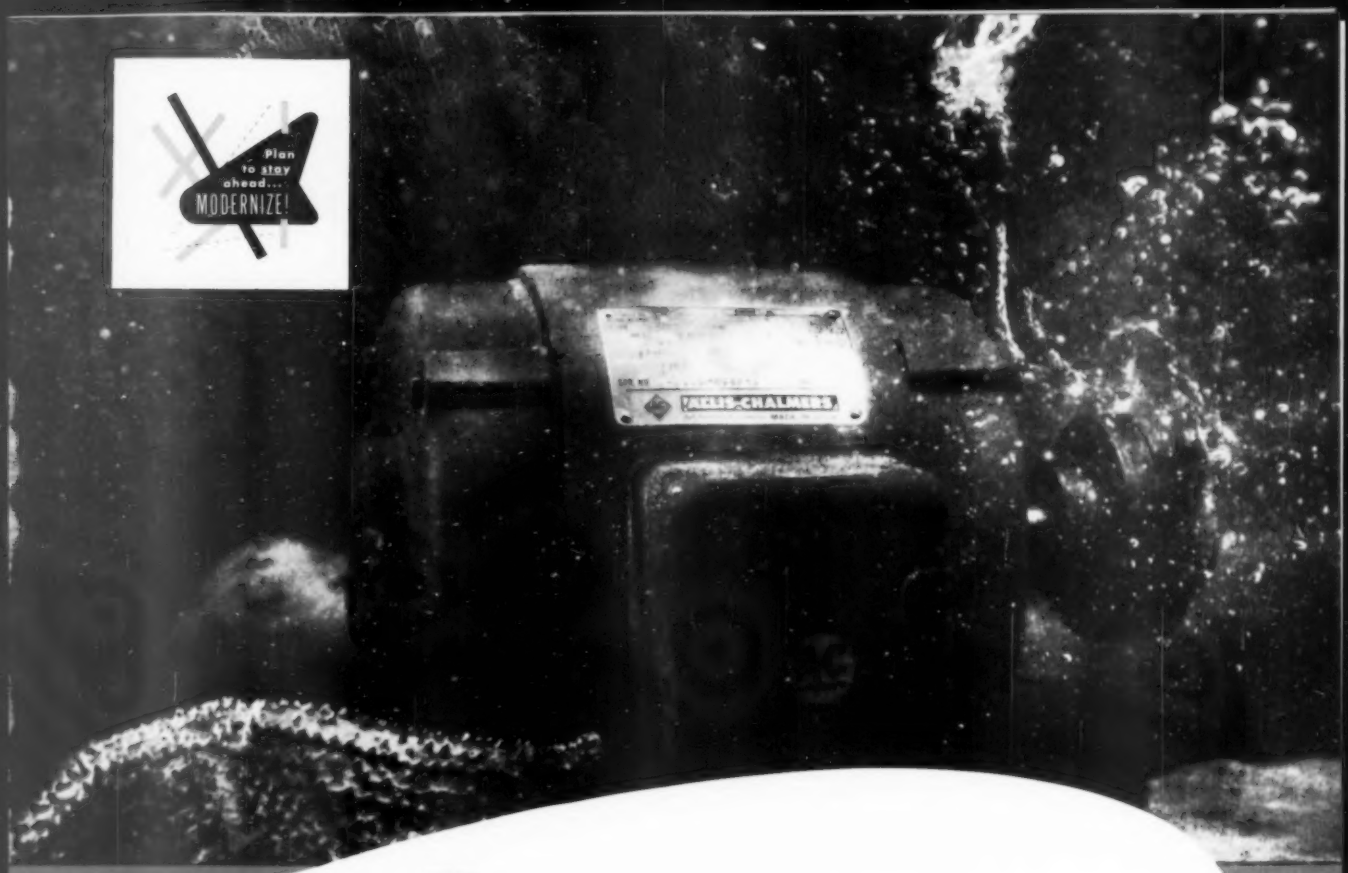
Caution: the award in this case is not an indication of how other arbitrators might rule in other apparently similar cases. Arbitrators do not follow precedents. Each case is decided on the basis of the particular history, contract, testimony and other facts involved.

Clerk Sorts Mail As the Truck Rolls

They're saying this new mail truck will pay for itself in 60 days at Convair's Astronautics Division (San Diego). What it does is spare clerks the trouble of returning all plant mail to a central sorting area for redistribution.

The unit relieves six to eight people for other work. Called a Marketeer, it services 1½ miles of corridor per hour on a continual basis, including loading and unloading time. It's operated by a two-man crew—a driver and mail sorting clerk. The clerk picks up and delivers the mail at required stops. He sorts items as he rides from one pick-up point to the next.

Basic unit cost $800. Special Convair modifications added another $1100 for a total of $1900. Main upkeep cost is recharging the truck's six batteries. These produce 4½ hp., provide the truck with a maximum speed of 6 mph.



New motor development obsoletes today's application practices!

Only from Allis-Chalmers!

Super-Seal motors save up to 60%

Here's an amazing advance in motor technology! It's the *Super-Seal* motor line — an open motor design so completely unaffected by moisture, dust, dirt, oil, acids and alkalies that it can be used in many applications previously requiring more costly enclosed motors. *Savings range from 15 to 60%.*

Super-Seal motor superiority results from two distinct revolutionary insulating techniques. Available in any integral horsepower size, smaller *Super-Seal* motors incorporate a *Poxeal* stator. A durable epoxy resin encloses the stator, creating an electrical system impervious to outside elements.

In larger sizes, *Silco-Flex* insulation is used. In this system, silicone rubber is vulcanized into a homogeneous mass to form a flexible, moisture and heat resistant, void-free dielectric barrier around coils and leads.

Both of these insulation systems are unsurpassed. Proof? An encapsulated motor ran for hundreds of hours at full load in a 4% brine solution.

Find out more by reading the next pages; then contact your A-C representative or distributor, or write Allis-Chalmers at address shown on back page.

ALLIS-CHALMERS

51B 9100

Two revolutionary insulating techniques developed and pioneered by Allis-Chalmers mean savings of millions of dollars for motor users . . .

New open motors are unaffected by moisture and contaminants

Modern insulating materials and new methods of application, now available in *Super-Seal* open-type motors, are drastically changing motor application standards. These insulations are so completely impervious to moisture and contaminants that *Super-Seal* open motors can be used in most applications formerly requiring costly enclosed designs. Existing applications have resulted in savings as high as 60%.

Basic insulation systems

Larger *Super-Seal* motors with form-wound stator coils use the *Silco-Flex* insulation system. Heart of this system is a remarkable rubber-like silicone elastomer, applied in semi-cured state and vulcanized to form a void-free, impervious dielectric barrier. More than four years of development and field testing have proven the superior electrical and physical properties of *Silco-Flex* insulation systems.

Stator coils of smaller random-wound motors are protected by equally effective *Poxeal* insulation system. A tough, durable case of epoxy resin completely seals the winding end turns and slot portions. Bonded to the stator laminations, it forms a seal completely impervious to contaminants.

Moisture resistance

In addition to being void-free, the silicone elastomer used in *Silco-Flex* insulation is moisture repellent. Even in high humidity, moisture does not form a surface film of condensation. Coils with this protection can operate completely immersed in water. In fact, one of the recommended cleaning procedures is use of detergent and water.

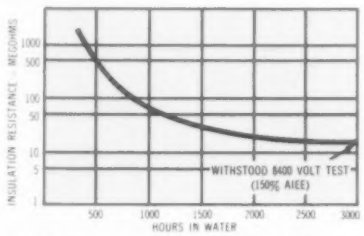


Fig. 1—Test curve shows insulation resistance of *Silco-Flex* insulation while immersed in water.

Moisture resistance of *Silco-Flex* coils is demonstrated in Fig. 1. After more than 3000 hours of total immersion with 2300 volts impressed on the coil, the test was terminated when it became apparent that little more drop could be expected in the coil's insulation resistance. At that point the coil still withstood a high potential test of 8400 volts without injury.

Encapsulated stator windings are equally well sealed. Motors with *Poxeal* insulation protection have been thoroughly tested under water while operating with full load and full voltage.

Resistance to contaminants

Silicone elastomers and epoxy resins are relatively inert to attack by practically all reactive agents. Further, the void-free construction of insulation systems used in *Super-Seal* motors prevents penetration of contaminants. As a result, *Super-Seal* motors are unaffected by oils, most acids, salt solutions, alkalies, and oils and are ideally suited for such applications.

Thermal stability

Temperature-wise, *Silco-Flex* insulation can easily withstand hot-spot temperatures of 200 C and more—

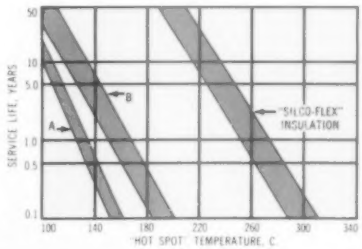


Fig. 2—Chart shows that *Silco-Flex* insulation more than meets Class H requirements.

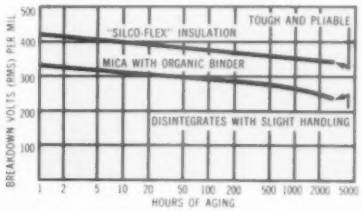
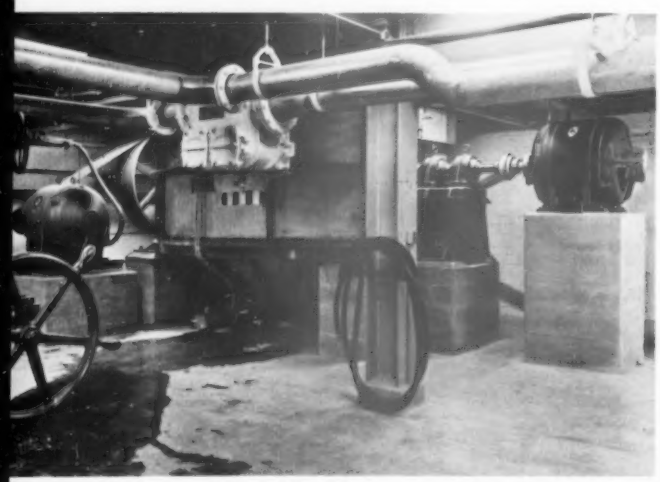


Fig. 3—Tests of 2300-volt insulated bars show thermal stability of *Silco-Flex* insulation.



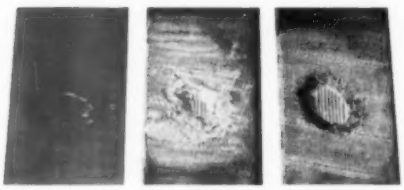
Paper mills have wide application for *Super-Seal* motors because of moist atmospheres.

easily meeting Class H temperature requirements (Fig. 2). At temperatures where the life of Class B coils would be measured in weeks, the life span of *Silco-Flex* coils is well beyond machine obsolescence.

Comparison with a mica-organic binder insulating system (Fig. 3) offers further proof of thermal stability. After 2000 hours of aging at 200 C with 8500 volts applied continuously, the *Silco-Flex* insulated coil was still tough, pliable, and completely serviceable. The mica-taped insulation had deteriorated to the point where it disintegrated readily and was completely useless.

An added advantage of *Silco-Flex* insulation is unusually high thermal conductivity — about twice that of conventional insulations. This means heat dissipates faster from its point of generation.

Poxeal insulation also demonstrates remarkably good thermal stability. Materials now in use are suitable for Class B temperatures, although actual classification of the insulation is determined by the basic material used.



Silco-Flex Insulation | Polyester Mica Tape | Asphaltum Mica Tape

Fig. 4—Samples of motor insulations after sandblasting give comparison of abrasion resistance.

Abrasion resistance

Resistance to abrasion is still another point of superiority in the insulation systems used for *Super-Seal* motors. Abrasion resistance of *Silco-Flex* insulation is compared to other types of insulation in Fig. 4. After one minute of sandblasting with 90-grit aluminum oxide and 100-psi air, only slight surface erosion appeared on the *Silco-Flex* sample. Other insulations were eroded to bare copper.

Application practices obsolete

The superior qualities of *Super-Seal* insulating systems, developed by Allis-Chalmers, make it necessary to reappraise present application practices. With virtually ageless insulation, *Super-Seal* motors assure more reliable service and require less upkeep than the best protected, conventionally insulated machines — and at considerably less cost.

Super-Seal, Poxeal, and Silco-Flex are Allis-Chalmers trademarks.

CHRYSLER KIMBERLY-CLARK GOODYEAR SOUTHERN CEMENT CONTINENTAL CAN AMERICAN OIL CELOTEX SCOTT PAPER HURON PORTLAND CEMENT FORD FIRESTONE PACIFIC GAS & ELECTRIC STANDARD OIL OF INDIANA B. F. GOODRICH DOW CHEMICAL MARLEY INGERSOLL-RAND LINK-BELT

WIDE ACCEPTANCE

of Super-Seal motors proves their advantages

Cement, petroleum, chemical, steel, mining, paper, utilities, municipalities and general industry — outstanding corporations in every field are specifying *Super-Seal* motors wherever operating conditions are tough.

Cost and *superior insulation* aren't the only reasons. Users are getting MORE MOTOR, too. Here's why:

Standard totally-enclosed motors, 55° C rise, have a *service factor of 1.* In other words, "nameplate" horsepower is the maximum. A 40° C rise *Super-Seal* motor with *Poxeal* insulation, and a 60° C rise *Super-Seal* motor with *Silco-Flex* insulation have a *service factor of 1.15.* For comparisons on what this difference means in required motor sizes, see this chart:

Rated Horsepower (Maximum Hp, TEFC)	Maximum Continuous Hp—*Super-Seal* Motor
15 hp	17.25 hp
25	28.75
40	46
75	86.25
125	143.75
200	230
350	402.5
500	575

Join the swing to *Super-Seal* motors. It will pay dividends fast. Contact your A-C representative or distributor, or write Allis-Chalmers at address shown on back page.

ALLIS-CHALMERS

SOUTHERN CALIFORNIA EDISON LONG ISLAND LIGHTING AVCO UNION BAG UNIVERSAL ATLAS UNION CARBIDE OHIO OIL INTERNATIONAL PAPER SOUTHERN PACIFIC PIPE LINE ALCOA ROHM & HAAS ARMOUR SHELL OIL COMMONWEALTH EDISON OWENS-ILLINOIS WYANDOTTE CHEMICAL BETHLEHEM STEEL ALLEGHENY-LUDLUM DU PONT DETROIT EDISON MEAD SINCLAIR PIPE LINE ESSO HERCULES POWDER GENERAL TIRE MONSANTO

This *SUPER-SEAL* MOTOR application SAVED $3000!

Find out how much you can save

This application of a *Super-Seal* open-type motor — in place of a weather-protected design of the same rating — *saved the user $3000.00!*

You can achieve similar savings! Fill out the data sheet below and *find out for yourself how much you can save — on a "no-strings-attached" basis.*

Here's what to do: 1) Select an enclosed motor application in your operations (a new motor need or, for comparison, a motor just purchased); 2) fill out the data sheet; 3) mail to the address shown.

We'll give you a cost quotation on a *Super-Seal* open motor for that application.

Fill out this data sheet—

no strings attached—to find out how much you can save on a new motor or on an existing motor installation

To: **ALLIS-CHALMERS**
888 S. 70th St., Milwaukee 1, Wis.

Motor Data

1. Type (i.e., squirrel cage):

Horizontal ☐ Vertical ☐

Hp ..... Rpm .....

2. Phase ..... Frequency .....

Voltage .....

3. (For synchronous only)

Power factor .....

Starting torque .....

Pull-in torque .....

Pull-out torque .....

Application Data

4. Description of application:

5. Drive: Direct-connected ☐

V-Belt ☐ Other: .....

Starting load .....

Ambient temperature .....

6. Operating conditions:

Dirty ☐ Clean ☐ Wet ☐ Dry ☐

Other .....

Information on Existing Motors
(for comparison)

7. Type of insulation

Type of enclosure

Time rating .....

Temperature rise .....

Bearings:

Anti-friction ☐ Sleeve ☐

8. Special characteristics or construction:

NAME .....

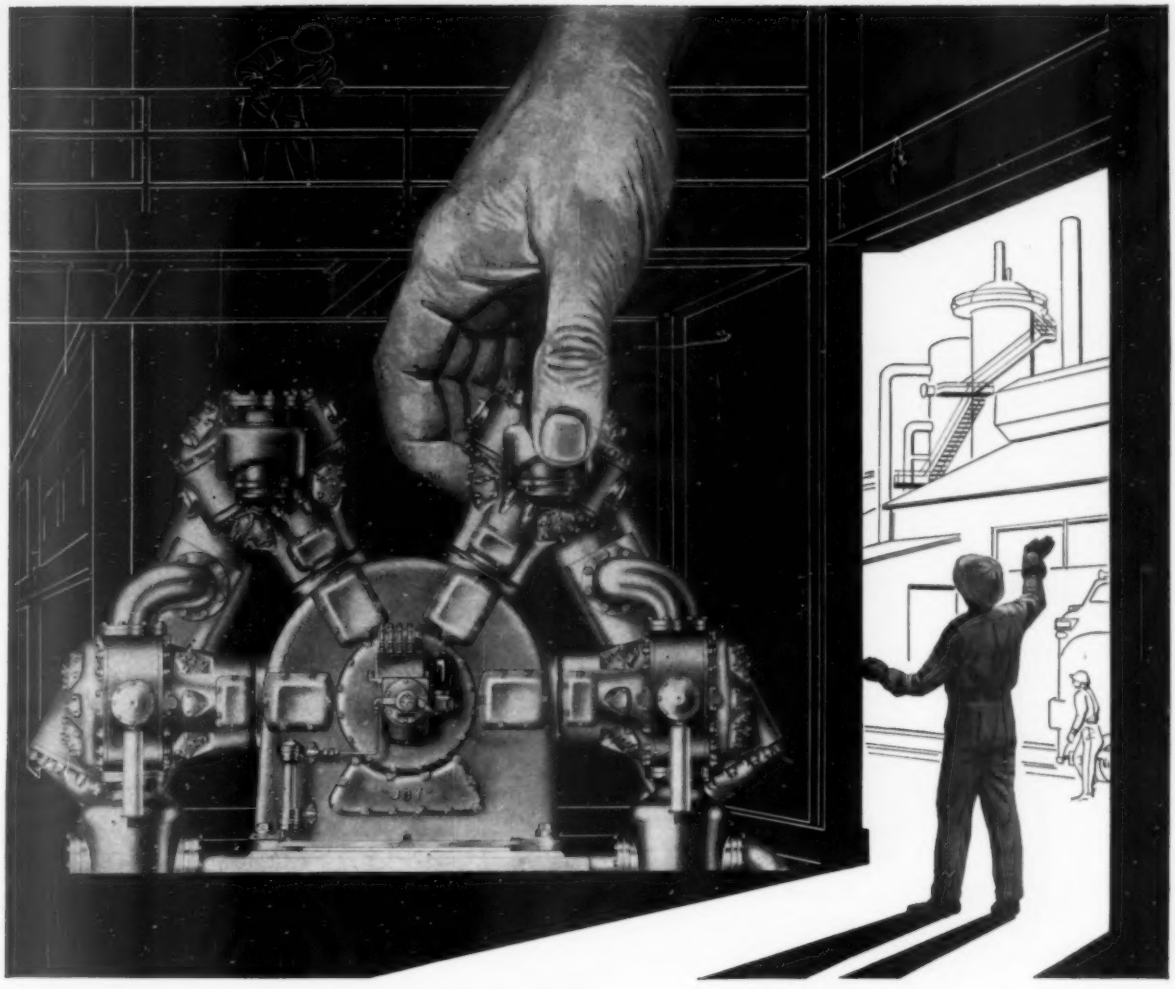
TITLE .....

COMPANY .....

ADDRESS .....

A-5869

ALLIS-CHALMERS



SET A 500 TO 1000 HP AIR COMPRESSOR IN THE CORNER OF YOUR PLANT . . . *almost as easy as this*

IF YOUR EXPANDING PLANT FACILITIES are requiring more compressed air . . . *and* putting a squeeze on plant space, here's the answer . . . the *new* Joy WN-224 compressor. Because of its compact semi-radial design, the WN-224 is delivered as a package—completely assembled—ready to go. Just bolt it down, connect power, water, and air lines . . . and you're ready for long, continuous service. This is the only true "package" compressor available in these capacities . . . 2418 to 6048 cfm . . . horsepower ratings from 350 to 1000.

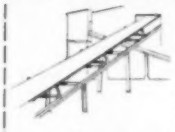
AND THE WN-224 SOLVES YOUR SPACE PROBLEMS . . . it can be installed where no other compressor of equal capacity will fit. Instead of long, horizontal units on massive foundations, the Joy WN-224 has four cylinders arranged semi-radially around the frame. This compact, balanced arrangement assures smoother running, gives longer service with far less maintenance. Get the whole story on the WN-224 from ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

WSW 1 6668-179

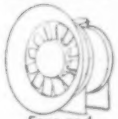
Write for FREE Bulletin 179-12

JOY . . . EQUIPMENT FOR INDUSTRIAL PLANTS . . . FOR ALL INDUSTRY

Industrial Compressors

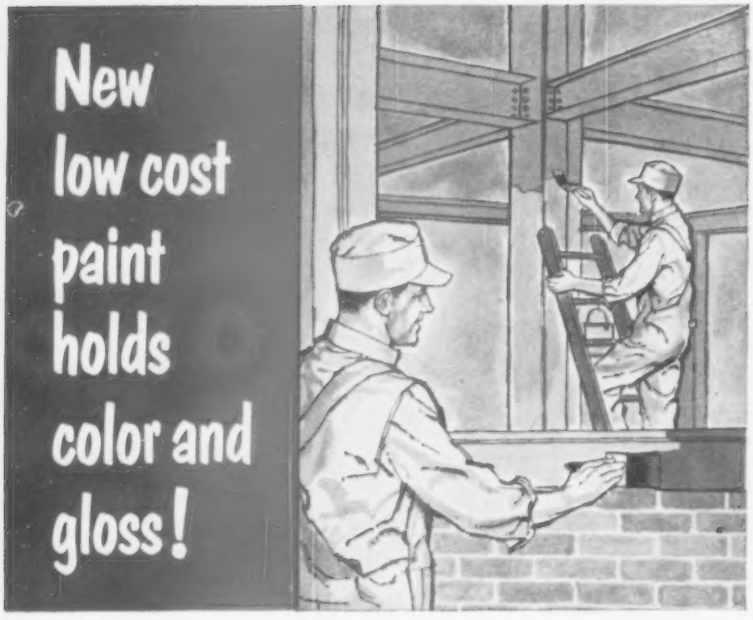

Conveyors

Electrical Connectors


Fans and Blowers

For more facts Circle 514 on Reader Service Card

For more facts Circle 515 on Reader Service Card



VALDURA DURAWEAR

Cuts maintenance painting costs yet gives "heavy duty" protection

Money-saving Durawear not only has top color and gloss retention, it gives extra protection to surfaces for many years. Featuring a linseed oil modified alkyd vehicle, Durawear has better brushability than straight alkyd enamels. It is very easy to paint on irregular surfaces since the consistency prevents running off from sharp corners. Use Valdura Durawear on steel, wood or masonry—indoors or out—as illustrated above, on fire escapes, wall surfaces, storage tanks, and wherever protection from elements of weather is desired. Available in five attractive colors.

Please send me complete information and color chips on Valdura Durawear.

VALDURA HEAVY DUTY PAINT DIVISION
AMERICAN-MARIETTA CO.
101 E. Ontario St., Chicago 11, Illinois

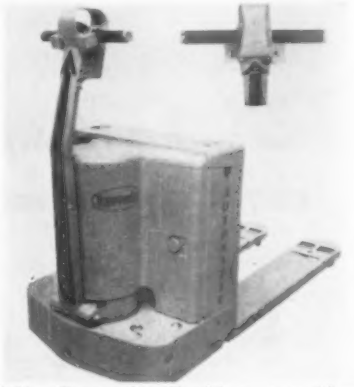
NAME_____
COMPANY_____
CITY_____ STATE_____

FACTORY / EQUIPMENT NEWS

Begins on page 88

For more about these items, circle item numbers on Reader Service Card next to back cover.

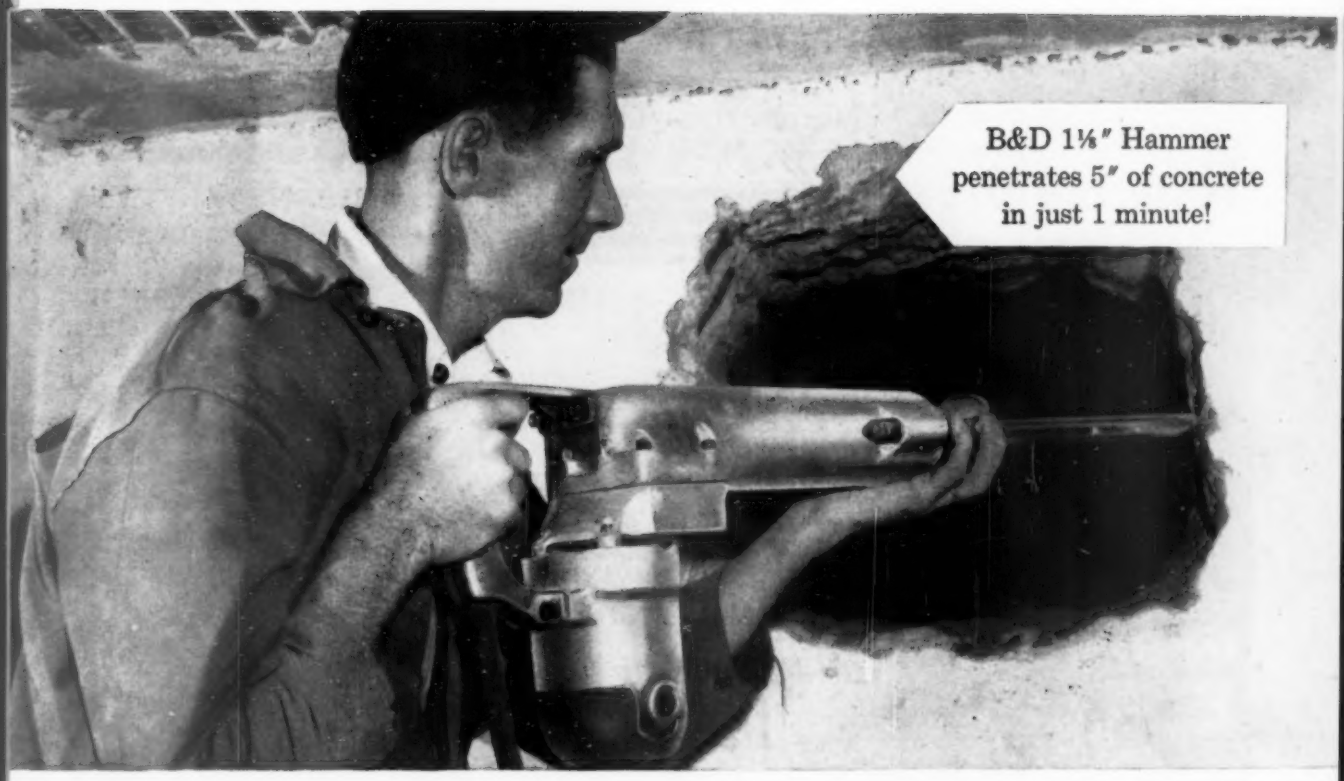
160—Pressure Check Valve eliminates corrosion by continuously rotating the nylon insert cap. Insert cap sizes range from ½ to 2 in. Valve is free from effects of static electricity. Pressure ranges from 250-lb. negative to 500-lb. positive. *Check-All Valve Co.*



161—Dynamic Braking provides separate fingertip controls on firm's line of operator-led Transporter trucks, handy for use where standard mechanical brake is difficult to use. For instance—on ramps, other inclines, or narrow aisles. *Automatic Transportation Co.*

162—Rubber Gloves of Pylox withstand deteriorating effect of nitric and chromic acids after 48-hr. immersion. Non-binding design of fingers and palms gives optimum finger sensitivity. Gloves resist alkalis, acids, oils, greases, and solvents. *Pioneer Rubber Co.*

Turn the page



11 times as much material removed 13 times faster than by hand!

Give your job a finished look with a Black & Decker Bushing Tool.

For the finest, and fastest work always specify genuine Black & Decker forged hammer tools.

Trenches for conduit are a cinch with a Black & Decker Cold Chisel.

Look for Swifty Service at one of B&D's 48 Factory Service Branches. There's one near you.

B&D 1⅛" Hammer drastically cuts cut-through time—labor costs!

Add a Black & Decker 1⅛" Hammer to your tool kit and watch how quickly it opens up your profit margin! It punches through concrete walls in minutes—opens the way for pipe and duct in a fraction of the time it takes by hand.

Plugs into any convenient outlet—the Black & Decker Electric Hammer takes on chipping, gouging, digging, caulking, pointing, and many other jobs! Mail coupon today for a free demonstration on your job-site! If additional information is desired just check the box.

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- ☐ Please arrange a demonstration of your 1⅛" Hammer.
- ☐ Please send me additional information on tools checked.

Name..... Title.....

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Address.....

City..... Zone..... State.....

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New features in an all new FEEDER

electro-permanent magnetic

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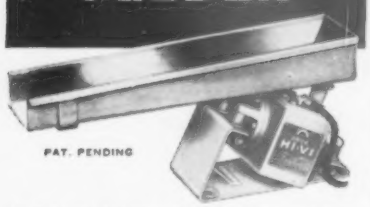
HI-VI VIBRATORY FEEDER



Here's the feeder *you** helped design! Provides accurate, uniform rate of feed of bulk materials – variable from ounces to tons. For spreading, sorting, aerating, cooling, proportioning, mixing, etc. Increases production, reduces maintenance.

TOTALLY ENCLOSED DRIVE ELEMENT FOR LONGER COIL LIFE • NO RECTIFIER NEEDED • SIMPLE INSTALLATION • JUST PLUG OR WIRE INTO A.C. LINE • NEW GLASS FIBER SPRINGS REDUCE BREAKAGE • NEW ELECTRO-PERMANENT MAGNETIC DRIVE PROVIDES GREATER FEEDING CAPACITY THAN COMPARABLE SIZE UNITS • PRE-TESTED AND STABILIZED AT FACTORY.

Industry Users —

ALSO AVAILABLE: Economical, specially constructed units for hazardous, dusty locations . . . fully acceptable by Mill Mutual.

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Eriez Mfg. Co., 70-PB Magnet Drive, Erie, Pa.

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FACTORY / EQUIPMENT NEWS

Begins on page 88

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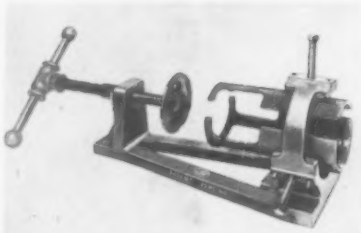
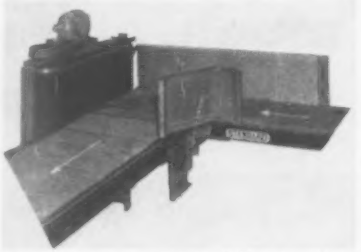


163—Hose-Coupling Press mechanizes installation of couplings into fluid-carrying hoses up to 3-in. dia. Portable and simple to operate, unit consists of a base, screw, centering plate, adjustable serrated hose jaws, guide pins, and centering screw. *Universal Valve Co.*



164—Conveyor-Belt Diverter is a low-cost, right-angle transfer unit for diverting various size cartons or packages. Separately powered feed, take-away, and vertical belts permit simple drive arrangements and lower your maintenance costs. *Standard Conveyor Co.*

165—Automatic Liquid Weigher accurately measures liquid by weight rather than volume. Weighs 10 batches per min.; handles loads from 1 oz. to 10 lb. Available with pneumatic or electrical controls, for semi-automatic or fully automatic operation. *Glengarry Processes, Inc.*

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ERIEZ

ALL NEW "Series 16" permanent PLATE MAGNETS are

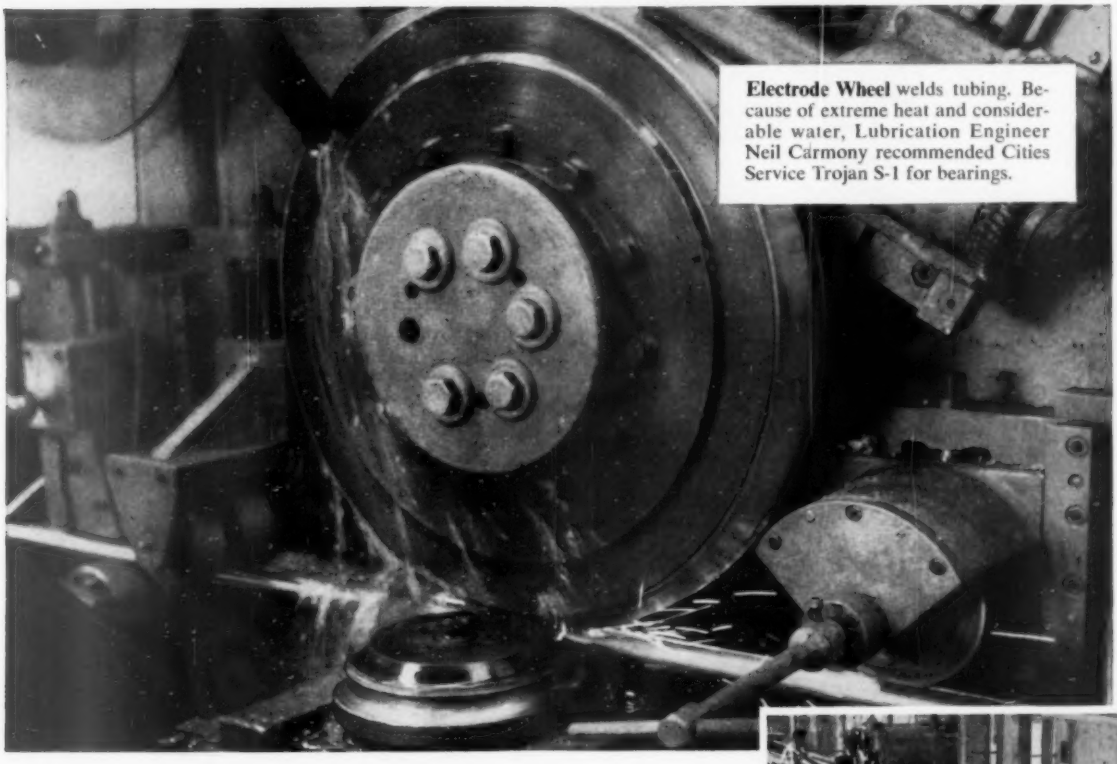
16 WAYS BETTER!

Tests prove NEW "Series 16" magnets with greater magnetic strength stop tramp iron cold! New heavy duty aluminum cover increases rigidity, prevents pilferage and disassembly with subsequent loss of magnetic power. Choose from many models and strengths . . . optional face plates for abrasive, corrosive or sanitary uses; liquid or dust-tight applications. It's a fact: "Series 16" magnets, with 16 superior features, provide ultimate operating advantages at price of ordinary magnets!

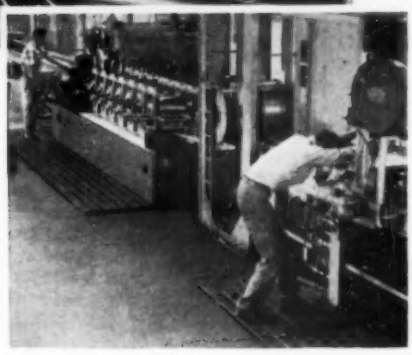
GET 6-PAGE FACT-FILLED FOLDER. WRITE TO
Eriez Mfg. Co., 70-PA Magnet Dr., Erie, Pa.

ERIEZ

New Tubing Mill Produces at Speed of 350 Feet Per Minute!



Electrode Wheel welds tubing. Because of extreme heat and considerable water, Lubrication Engineer Neil Carmony recommended Cities Service Trojan S-1 for bearings.



It's Cities Service for Hydraulic System and all lubrication

On January 1, 1957, P&H Tube Corporation put a new mill in production at Bossier City, Louisiana—the only one of its kind in the United States.

Equipped with special drives and worm gears, this unique mill actually produces at the rate of 350 feet per minute—twice the speed of conventional tubing mills!

With speeds like this, you might expect lubrication troubles . . . but P&H Tube Corporation has none. One big reason is the careful study of each machine made by Cities Service Lubrication Engineer Neil Carmony—and the lubrication recommendations he made.

In hydraulic units, for example, Carmony recommended Pacemaker 200-T Hydraulic Oil . . . for he knew its ability to withstand the severest operating temperatures and speeds. He knew that due to its exceptionally high viscosity index and superior compounding, Pacemaker 200-T would give maximum resistance to thinning, oxidation, rust and corrosion.

The wisdom of this decision, as well as the choice of other lubricants shown in the chart at right, was demonstrated recently when P&H Tube Corporation ran off 125,000 feet of tubing in an ordinary eight hour shift—with normal time-out for change-overs!

That's production with a capital P! And if you'd like to improve your production picture, a Cities Service Lubrication Engineer can help you, too. Call the nearest office or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

What the Cities Service Lubrication Engineer Recommended

Hydraulic units	Pacemaker 200-T
Bearings	Trojan H-2 Grease
Drive units	Pacemaker Oils
Bearings by the mill's electrodes	Trojan S-1

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more facts Circle 523 on Reader Service Card

THE
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• FAST, SAFE AND SIMPLE INSTALLATION
• MAXIMUM VIBRATION CONTROL

Unisorb gives you a complete line of vibration control machine mounts for simplifying machine and equipment installation everywhere in your plant. Unisorb pads, proven for over twenty years, are engineered to handle the "vibration personality" of different machine types and loadings. Unisorb Level-Rite combines the advantages of Unisorb pads with a precise, efficient leveling device that greatly simplifies all types of machine mounting. See how these features can help you in your plant.

- Absorbs up to 85% of transmitted vibration
- Eliminates bolts and lag screws, no floor damage
- Saves from 30 to 75% — by actual report — in installation time
- Machines can be moved at any time
- Lowers noise level, improves worker morale
- Protects machines from vibration, preserves building

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FACTORY / EQUIPMENT NEWS

Begins on page 88

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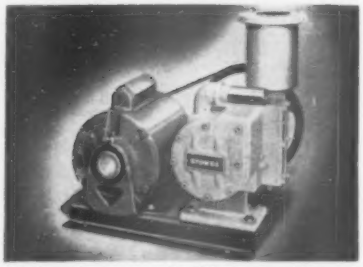
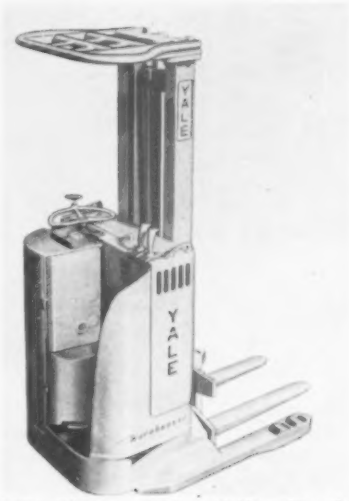


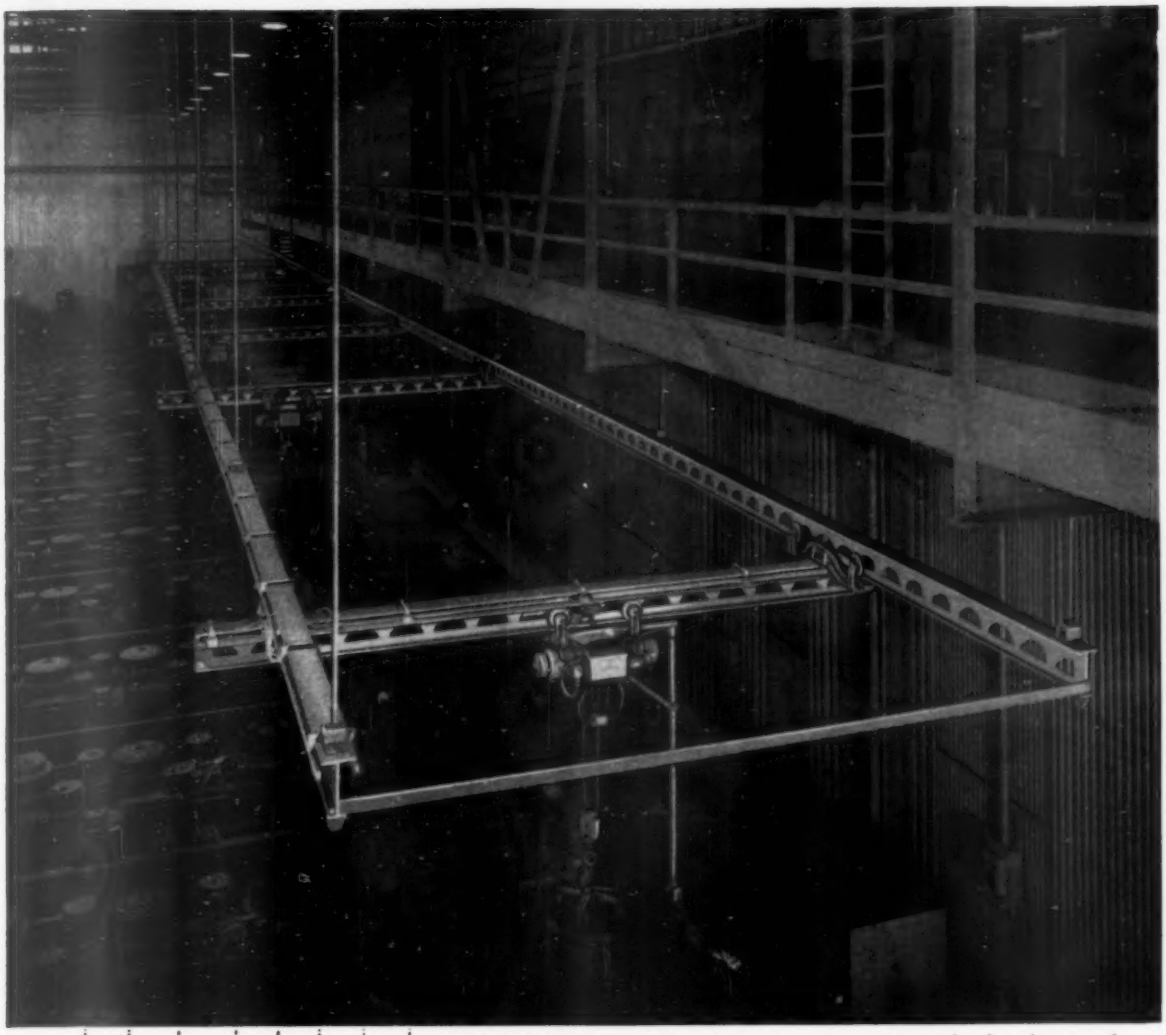
166—Compound Vacuum Pumps are quiet, vapor-free, compact, lightweight, portable units in 2.3- and 3.7-cfm. sizes for laboratory and production applications. Useful where rapid pumping and an ultimate blank-off pressure of 0.1 micron are desired. *F. J. Stokes Corp.*



167—Narrow-Aisle Lift Truck, powered by 24-v. electrical system, operates comfortably in aisles under 6 ft. with normal loads. Straddle-stacker models of 2000-, 3000-, and 4000-lb. capacity require lower amperage to move and raise loads. *Yale & Towne Mfg. Co.*

168—Tube Threading Tool comes with three steel dies and guides, easily interchanged, for precise cutting of No. 27 thread on 1¼-, 1⅜-, and 1½-in. brass tubing. Aluminum alloy holder holds the tubing securely for threading, flaring, cutting. *J. A. Sexauer Mfg. Co.*

Turn the page



This installation consisting of seven hand-propelled cranes on a flexibly suspended runway is used for stripping wire blocks in a large steel mill.

Note how easy it is with the Cleveland Tramrail design to position the runway at any level or location desired. Likewise, it is extremely simple to dismantle and relocate the equipment to serve some other application, should such ever be necessary.

FLEXIBLE SUSPENSION

Assures Smooth Crane Operation

CLEVELAND Tramrail's unique flexible suspension method of supporting crane runways prevents binding of wheels on the tracks and assures smooth easy rolling operation, regardless of location of the load on a crane bridge.

The floating runways compensate automatically for normal skewing or twisting of crane bridges.

This is one of the reasons why hand-propelled Cleveland Tramrail cranes can be used for so many jobs where motor-driven cranes would otherwise be required.

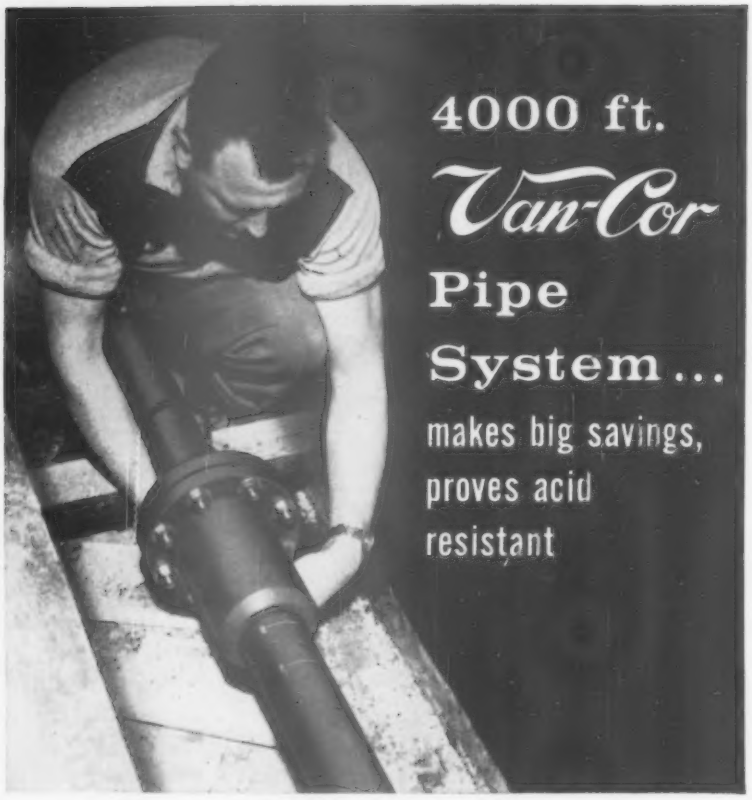
Operation is so easy that Cleveland Tramrail guarantees a starting effort of 15 lbs. and running effort of 10 lbs. per ton weight.

Write for free copy of illustrated booklet No. 2008, "Engineering and Application Data".

CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 3212 E. 290 ST. • WICKLIFFE, OHIO



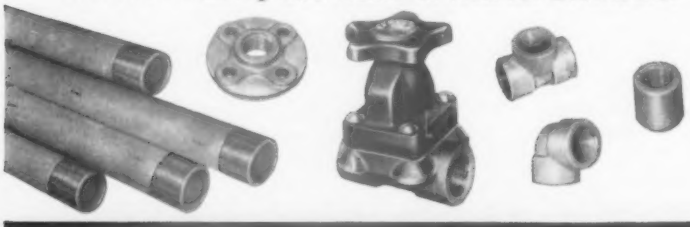
At the Allentown (Pa.) Works of the Western Electric Co., the entire waste acid disposal system in the recent addition consists of Van-Cor rigid PVC pipe and fittings.

HOW COSTS WERE CUT. Initial price of Van-Cor was ⅓ that of comparable cast iron alloy pipe. On a 6" line, labor costs were estimated at 29¢ per foot of run—about half that of metallic pipe. Also, because Van-Cor has only 1/10 the weight, no mechanized handling equipment was needed. Available in 10 or 20 ft. lengths, Van-Cor requires fewer joints, and eliminates the breakage problem.

CORROSION LICKED. Van-Cor pipe was used because "corrosion resistant" cast metallic pipe had performed short of expectations in an adjacent building. After 1½ years service, the Van-Cor system is in excellent shape, unaffected by such acids as hydrofluoric, hydrochloric, sulphuric, nitric and many plating solutions.

Investigate Van-Cor Pipe, Fittings, Valves, Electrical Conduit, and Fabrications . . .

Write for Catalog and Name of Nearest Distributor



INDUSTRIAL DIVISION OF...
COLONIAL PLASTICS MFG. CO.
Subsidiary of THE VAN DORN IRON WORKS CO.
2685 EAST 79TH STREET CLEVELAND 4, OHIO

FACTORY / EQUIPMENT NEWS

Begins on page 88

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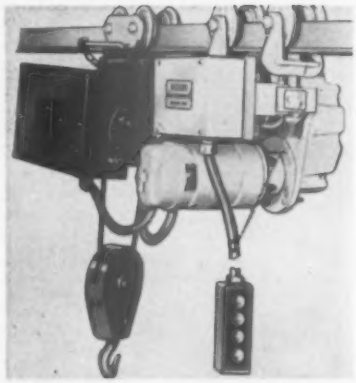

169—Electric Monorail Drive provides powered travel for hoists or other load carriers. Handles live loads to 5 tons at travel speeds to 2000 fpm. Operates on any type monorail system—one beam or patented track with clear undersurface. *Becker Crane & Conveyor Co.*

170—Continuous Flow Filters for cleaning cutting oils, coolants, and lubricants remove over 95% by volume of suspended solids. Eight tubular models range in capacity from 600 to 10,000 gph.; are automatically self-cleaning and precoating. *Olson Filtration Engineers.*

171—Walk-in Enclosures provide outdoor, all-weather protection for 2000- to 5000-v. Type H motor controls. Two facing rows of cabinet controls form outside walls. Rows are bridged by metal roof, separated by a 5-ft. aisle with doors at ends. *Allis-Chalmers Mfg. Co.*

For more facts Circle 526 on Reader Service Card
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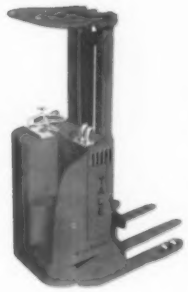
NEW Yale Warehouser builds profits 3 ways

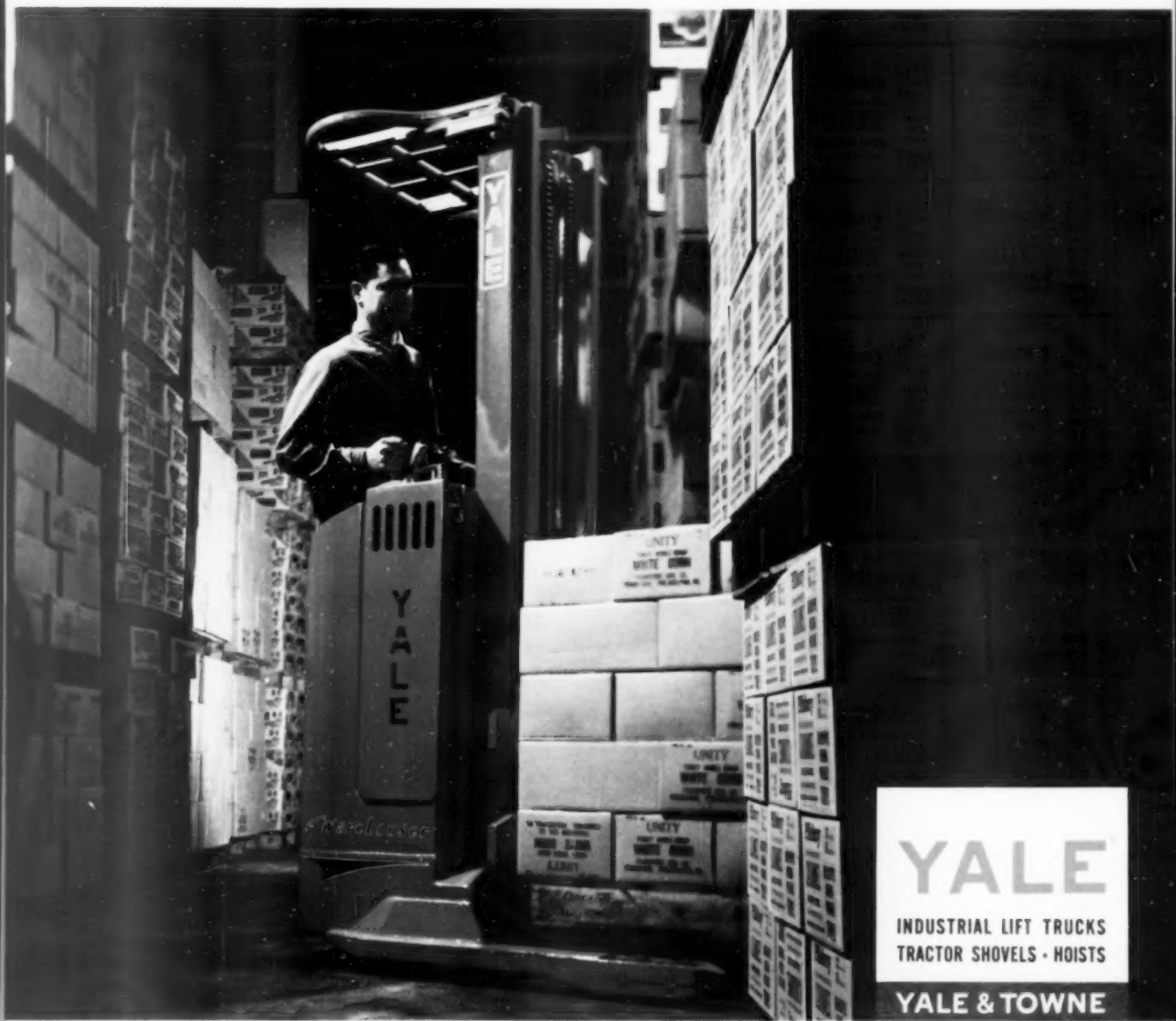
(1) 24-volt system speeds operation cycles (2) Advanced design increases operator efficiency (3) Rugged construction means more time on the job



There's more power in the new Yale Warehouser! 24-volt battery provides faster lift and travel! Faster operation cycles! And your operator will be less fatigued at the end of the day. He has comfortably positioned, easy-to-operate controls! This precision control plus increased visibility protects against product damage.

Your new Yale Warehouser spends more time on the job! More days on the job! Operational maintenance is minimized because all components are in one fully-accessible compartment. More years on the job! Construction is durability itself! Service access doors protected against bumps! Frame, chassis, outriggers and channels are a single welded unit.

This new Yale narrow aisle truck is available in straddle and Extend-A-Fork models—in capacities of 2,000, 3,000 and 4,000 lbs. Standard 12-volt models also available. Contact your Yale representative or write for brochure #1535H. The Yale & Towne Mfg. Co., Yale Materials Handling Div., Phila. 15, Pa., Dept. RT 1-H.



YALE

INDUSTRIAL LIFT TRUCKS
TRACTOR SHOVELS · HOISTS

YALE & TOWNE

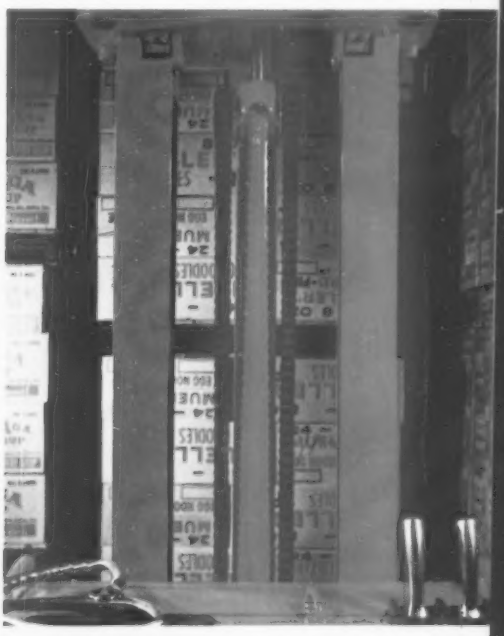
Yale Materials Handling Division, a division of The Yale & Towne Manufacturing Company. **Manufacturing Plants:** Philadelphia, Pa., San Leandro, Calif., Forrest City, Ark. **Products:** Gasoline, Electric, Diesel and LP-Gas Industrial-Lift Trucks • Worksavers • Warehousers • Hand Trucks • Industrial Tractor Shovels • Hand, Air and Electric Hoists

Your operator will be sold on the New Yale Warehouser

SEE HOW EASILY your operator will maneuver in a tight aisle. The new Warehousers can perform in aisles as narrow as 6'. Extra powerful 24-volt battery takes no extra operating space. Rugged construction assures stability at all times.

YOUR MAINTENANCE MEN will find it easy to service the new Warehouser. All components in a single compartment that opens wide. Access doors hinged in positions of protection against bumping—means no sprung doors. These and all the other advanced features of the new Warehouser are standard equipment.

CONVENIENT CONTROLS. Steering wheel has directional compass and contoured handle. Pistol-grip controls for forward and reverse movement, lifting and lowering. Operator will be less fatigued even though extra power increases operation cycles.



OPERATOR POSITION AND COMPACT DESIGN provide better visibility. He is positioned so that he can see forks and outriggers whether raised or lowered. This safety factor is buttressed by another – rubber sheathing protects operator at points of bodily contact.

YALE PRODUCTS MEAN EXTRA PROFITS TO INDUSTRY

Yale makes available to industry the complete lines of industrial lift trucks, tractor shovels and hoisting equipment that lower production costs—speed distribution—mean greater profit margins because you get faster delivery of your products into your market —can price your product competitively for increased sales.

YALE

INDUSTRIAL LIFT TRUCKS
TRACTOR SHOVELS • HOISTS

YALE & TOWNE

Yale Materials Handling Division, a division of The Yale & Towne Manufacturing Company. **Manufacturing Plants:** Philadelphia, Pa., San Leandro, Calif., Forrest City, Ark. **Products:** Gasoline, Electric, Diesel and LP-Gas Industrial Lift Trucks • Worksavers • Warehousers • Hand Trucks • Industrial Tractor Shovels • Hand, Air and Electric Hoists

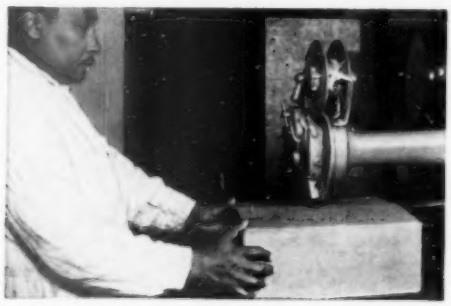
Stapling slashes costs, solves tough shipping and packaging problems for food industry

All industries have fastening problems, but they're especially critical in the food field. That's why you'll find Bostitch stapling so widely used by growers, packers and retailers.

Stapling's speed helps move perishables to market fast—for top prices. It cuts costs to safeguard profits. Staples are strong and sure. They withstand moisture and changes in temperature. 800 Bostitch staplers and 200 sizes and types of staples meet a wide range of fastening requirements.

You may need a fastening method that offers these benefits. Chances are good that Bostitch stapling can help you. One of over 300 Bostitch Economy Men, who work out of 123 U.S. and Canadian cities, will gladly investigate. He's listed under "Bostitch" in your phone directory—or send us the coupon.

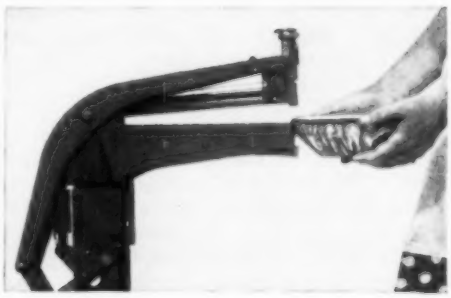
Stapling lettuce cartons in the field is 3 times faster than wire binding—quick adjust knob sets stapler for varying board thicknesses or bulging contents.



Leading meat packer finds stapling cartons 33⅓% faster than nailing wooden boxes. Increases production while cutting labor and material costs.

Stapling beats hand tying 2 to 1 sealing grapefruit bags at citrus grove. The special forked blade speeds fastening of mesh and cloth bag drawstrings.

50 pounds of refrigerated live lobsters go in this stapled corrugated container. Stapling provides a more secure seal when boxes get wet and is faster than tape formerly used.



Stapling covers to plates for frozen pies. Staples withstand extremes of cold and moisture—pies arrive in perfect condition.

Fasten it better and faster with

BOSTITCH®
STAPLERS AND STAPLES

Bostitch, 602 Briggs Drive, East Greenwich, Rhode Island

☐ Please send me information on stapling in the food field. I'm especially interested in stapling for _____

☐ Please send free bulletins on ways stapling cuts costs for other businesses.

I want to fasten: ☐ corrugated board ☐ cartons ☐ fabric ☐ leather ☐ plastic bags ☐ wood ☐ roofing ☐ rubber ☐ light metals

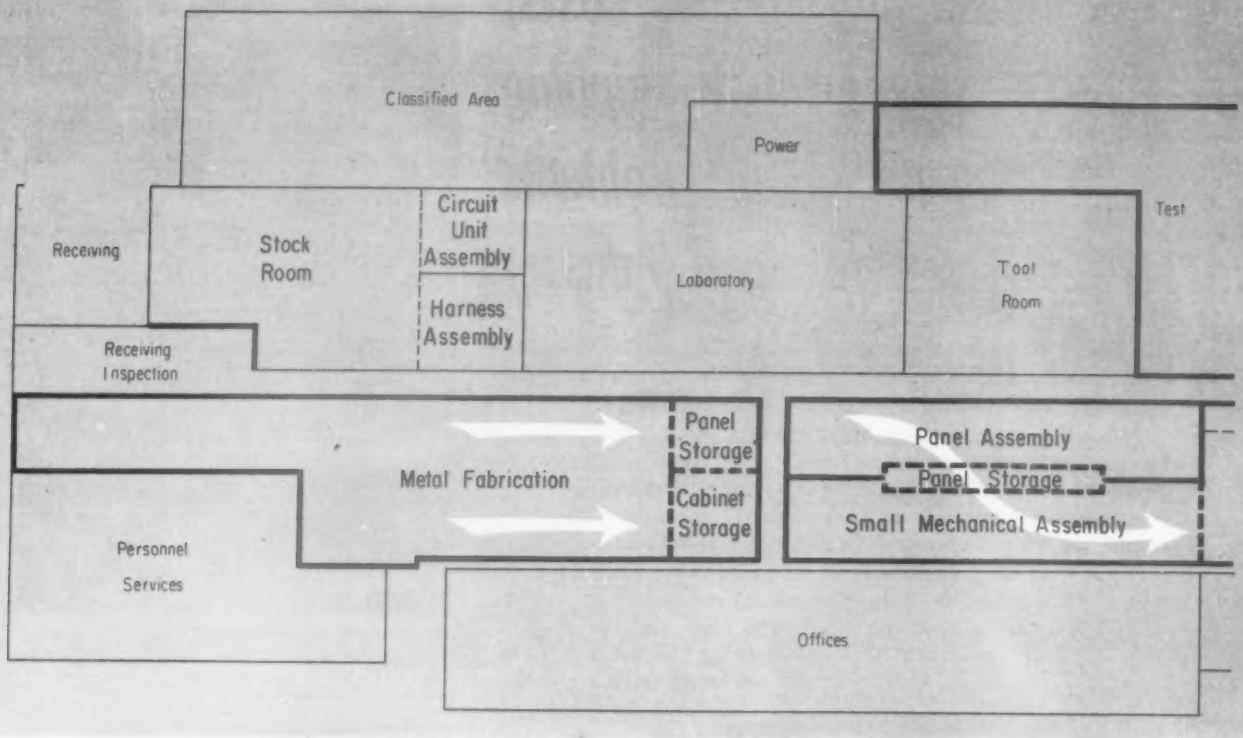
Name _____

Company _____

Address _____

City _____ Zone _____ State _____

Planning for 1960 -- Point-of-Use Storage in All Production Areas



With eyes on 1960, Reliance Electric shapes a new layout for P-O-U

MANAGED MODERNIZATION At Work

Newest Trend for Job

It's old hat on assembly lines. Now it's coming up fast in job shops. So says this round-up of case histories and opinion from 10 pacesetting plants.

NEXT STEP forward in job-shop manufacturing will be point-of-use storage. This is the conclusion of FACTORY editors. They base their conclusion on interviews with plant executives in ten companies in FACTORY's continuing study of managed modernization at work.

Point-of-use (P-O-U) storage is storing materials and parts where they'll first (or next) enter production. It's a "must" in mass production. If you aren't using it for continuous-production assembled products, you're behind the times. The volume turnover of like parts makes a luxury of more than one handling from receiving to first operation. Says D. C. Appleby, plant manager of Chrysler Corporation's Los Angeles assembly plant: "In our type of operation it would be almost impossible to operate from a central storeroom."

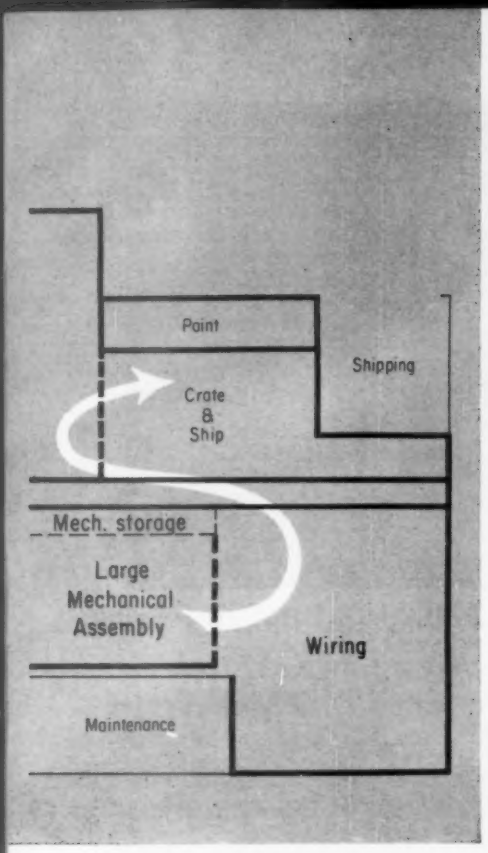
Only a few job-shoppers use the technique today. Most say they think it isn't practicable for anything except fast turnover of product components. What's more, even some mass-production executives concede this point of view.

On the other hand, a few pioneering job shops have switched from central storeroom to decentralized storage. What it has done for them indicates it's a good idea—good for any job shop. That's why we say P-O-U storage is the next big change in job-shop operations.

Precisely, now, what is it?

The P-O-U concept is very simple. As materials and parts enter the plant they're checked, moved on to the point where they'll first be used, stored there until used. Gone is the practice of moving parts between central storage and processes.

Basis of the scheme is that the ideal plant would have no storage at all of raw materials and components. Suppliers would feed starting materials directly to their first operations precisely as needed. But that's just a dream. For practical reasons every plant must carry a stock of what it will need—or what someone thinks it will need. P-O-U storage reaches for the ideal. At least, it puts materials where they're needed on the first move.



storage. Wiring area (above) is already changed to P-O-U.

Shops Is Point-of-Use Storage

ADVANTAGES ADD UP

All executives FACTORY interviewed agreed that P-O-U storage cuts handling labor costs. But there are other benefits, too:

- Speeds materials to production (Delco-Remy Div., General Motors Corporation, Anaheim, Calif.).
- Cuts paperwork costs (Chrysler Corporation, Maywood, Calif.).
- Utilizes idle space (Lockheed Aircraft Corporation, Marietta, Ga.).
- Cuts damage to parts (Ordnance Division, Food Machinery & Chemical Corporation, San Jose, Calif.).
- Cuts deliveries to wrong stations, improves flow through assembly (Control Div., Reliance Electric & Engineering Company, Cleveland).
- Cuts delays, provides visual check of inventory (Automatic Electric Company, Northlake, Ill.).

BUT NOT A CURE-ALL

P-O-U storage has its disadvantages, too:

- Adds inventory responsibility to production line people. Makes the planning job more exacting.
- Weakens control of damaged parts. There's a tendency to put rejects back in P-O-U stock instead of replacing them. Then the end of the lot turns out all rejects.
- Makes it harder to recall parts than if they were all in one place. But this is necessary only when parts are wrong or become obsolete.
- Relaxes accountability of materials. Production supervisors are not so interested in inventory control as stores specialists.
- Taxes ingenuity in fitting stores into P-O-U space. But forces better use of space.

LONG USED IN ASSEMBLY

High-production plants, particularly in the auto industry, have been using P-O-U storage for many years. "To my knowledge," says Chrysler's D. C. Appleby, "it has been common in the auto industry ever since the industry has been on a high production

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Begins on page 144

basis." Over 99% of production parts are delivered directly to the point of use in the Los Angeles assembly plant.

Ford Motor Company's Lincoln assembly plant at Wixom, Mich. (a FACTORY "Best Plant" in 1958), was designed for P-O-U storage. Almost everything moves directly from transport to point of use. The only exception is the rare instance of storage at points other than points of use when the plant is hedging against a possible supplier strike shutdown. Although autos are a high-volume product, it must be remembered that they're not all exactly alike. Lincoln Plant Manager W. D. Singleton says that the plant could theoretically build Lincolns and Thunderbirds for 20 years without making two cars exactly alike.

White Motor Company (Cleveland) builds trucks in a 50-year-old plant designed for basement central storage. The company's purchased parts represent 75% of the total material dollars. There's considerable variety in its trucks, too. But White switched to P-O-U storage 15 years ago in its continuing modernization program. Eighty per cent of the production materials are now moved directly to points of use.

Others in the high-production class using P-O-U storage include:

. . . *Delco-Remy Division of General Motors Corporation.* Over 99% of production materials in its Anaheim battery plant are stored under the P-O-U system.

. . . *The Franklin Park (Ill.) TV-radio-stereo plant of Motorola, Inc.* It started up six years ago using P-O-U storage.

. . . *Automatic Electric Company.* It built P-O-U storage into its Northlake (Ill.) telephone assembly plant (a 1958 FACTORY "Best Plant").

. . . *The San Jose plant of Food Machinery & Chemical Corporation's (FMC) Ordnance Division.* In about a year its output jumped considerably. To enlarge central storage correspondingly would have required plant expansion. But the plant solved the space problem with P-O-U storage. Around 70% of stores is now at point of use.

But, you say, these are high output plants. How about the job shops?

P-O-U storage means less loss and damage . . .

no obstacles to production . . .

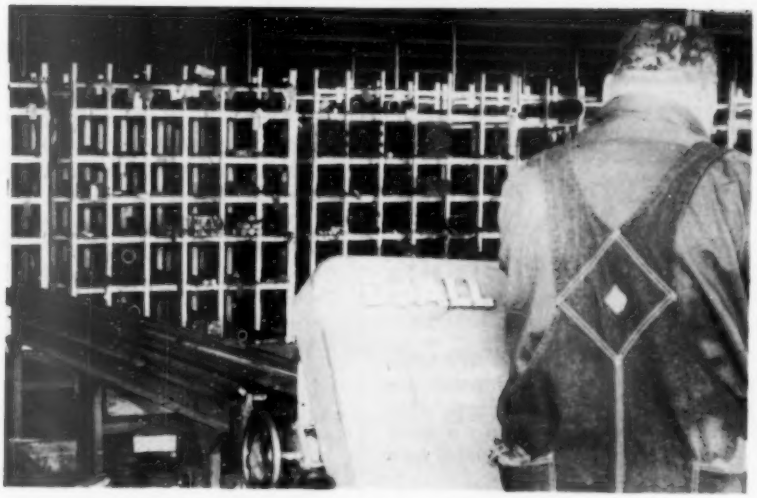
Point-of-Use Storage—What's

P-O-U storage helps cut costs. The photos and captions above show it at work in four plants, tell how it saves money four ways. What's more, it saves on handling costs. And saves on paperwork.

Saves on handling—It's obvious when you compare the number of handlings. In P-O-U storage you handle the material once, maybe twice before conversion begins. In a central stores system there's handling to and within the storeroom, handling to get the material out and to the place of need. The number of handlings is two or more times that in a P-O-U system. Unless your shop is so small that one man does all the handling, there's a good chance of reducing your handling labor.

Saves on paperwork—Savings come by eliminating the moves. It takes one to several pieces of paper to generate a planned move of material—one set of papers to get it into storage, another set to get it out. If material strays or is damaged in these moves, more papers are needed. Cost of paper, even in the

easy-to-get-at materials . . .



minimum floor space for materials.

in It for Job Shops

shape of printed forms, may not be much. But processing and administering paperwork is a big and growing cost today.

Saves on space—At first glance, seems more floor space would be needed. But those who've switched say they've cut plant storage area. FMC avoided plant expansion by changing to P-O-U storage. Reliance Electric says its central stockroom will be cut over 50% by the time changes are completed (layout diagram, pages 144-45).

First, of course, when you move some of central stores to point of use you can reduce the size of the storeroom. But—and here's the trick—you don't add the equivalent space to the production departments where you store the materials at the point of use. The floor space occupied by stored parts in a production area may be just as great as the space they took in the storeroom. But space usually can be found or made by utilization of wasted area or by more efficient layout of production.

Also P-O-U storage focuses attention on storage methods. In effect, it opens the storeroom to the eyes and ideas of more people. Usually, materials are stored more efficiently after they're moved from storeroom to point of use. The discussion of storage facilities on pages 154 to 158 explains how to improve storage efficiency.

Each handling of a part exposes it to loss by misplacement or to damage by carelessness. Therefore the fewer the handlings, the less the chance of losing or damaging the parts or materials. Again, this fact is supported by companies that have changed to P-O-U storage recently enough to make comparisons. Lockheed, FMC, and Reliance all cite savings in damaged parts and materials.

Saves other ways, too—Although it's mighty important, direct cost reduction isn't the only argument for adopting P-O-U storage. There are others:

- It's convenient to production to have parts stored at hand. If replacement for a part is necessary, there's no need to requisition the storeroom and no need to hold production until the part is delivered. There's no delay, no extra paperwork. All that's needed here is to report the unusable part—and to pick out another.
- Parts and materials are under the eyes of those who are directly concerned with having enough. Visual checking of stores doesn't replace an inventory control system—the use of records to determine inventory levels and needs for reordering. But mistakes do occur. The records may show enough on hand when there's actually a shortage in the bins. It may go unnoticed in the storeroom. Foremen and workers are more likely to spot the shortage in the bins, and yell for a check.

NEW PRACTICES COMING

Looking ahead a little way, what's likely to happen in job shops that will make P-O-U storage even more attractive? Several practices now on the uptrend will affect its consideration for use in job shops.

These practices are as diverse as simplification and standardization of materials and components, numerical control of machine tools, computerized production and inventory control.

Turn the page

Two A-W hydraulic cranes demonstrate materials handling abilities at Dorr-Oliver plant, Hazelton, Pa.

Twin Austin-Western 5-ton cranes speed materials handling operations

"We are well pleased with our two Austin-Western hydraulic cranes," says A. E. Oelschlager, shop superintendent of the Dorr-Oliver's Hazelton, Pa., plant. Dorr-Oliver manufactures filtration, separation and classification machinery and equipment for industrial processing.

Versatile, easy to operate

"Our first A-W crane, new in 1954, performed so well we bought a second in 1957 to meet increased production demands. They are dependable units . . . always ready to work two shifts daily if needed.

"The A-W cranes speed railroad car loading and unloading. They handle structural and bar steel, lumber and fabricated parts enroute to and from storage. With a plow attachment, they keep the plant free of snow. Our operators like them because the hydraulic controls are simple and easy to operate. Distributor service has been excellent, and maintenance requirements have been normal."

All-wheel drive, steering

Learn of the many time and money-saving applications of this versatile materials handling crane. Its features include all-wheel steering for exceptional maneuverability; all-wheel drive for power and traction on any surface; 18-ft. telescoping boom with full circle swing; rubber mounted; self-propelled, speeds to 35 mph; choice of gas or diesel engine.

Investigate now! See your nearest Austin-Western distributor or write to us.

Austin 100th YEAR Western
CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.
BALDWIN · LIMA · HAMILTON
Power graders • Motor sweepers • Road rollers • Hydraulic cranes

POINT-OF-USE STORAGE

Begins on page 144

Simplification and standardization of materials and components tend to make one component fit into more products. The number of different components is reduced. The usage of the standard component is higher than any of those made obsolete. When a component reaches a high usage level, P-O-U storage is an economic necessity.

Numerical control of a machine almost always boosts its production rate by a big percentage. (See "Numerical Controls," FACTORY, February 1958, page 137.) The problem of supplying materials gets progressively stickier when you jump a machine's production rate. Then P-O-U storage of materials begins to look more advantageous.

So far, computers have made only slight penetration into inventory and production control in the less-than-very-big job-shop plants. But there's every reason to believe computers will become practical and economical for the smaller plants, too. When that time comes, inventories will be easier to control, no matter how widely dispersed throughout the plant.

Adapting P-O-U storage to job shop operations isn't easy. You can't reap its benefits by decreeing 100% P-O-U storage for everything, then moving everything overnight. The plants that have switched have done it gradually. They started with obvious items, added more as they gained experience in solving the problems. None of the job shops will ever reach 100%. The 1960 plan of Reliance Electric includes a small central storeroom. Its main purpose: to store items made in large quantities for future use.

P-O-U FOR MANY MATERIALS

Plants that use P-O-U storage don't agree completely on what can be stored at points of use. Take small hardware. Some do store it at using points, others don't. Same is true of large bulky parts and raw steel. If you want to take an arbitrary position, you can defend it with lists that include or exclude practically everything—and cite an example for every one.

There's complete agreement on

How RYKON GREASE

has performed in six tough applications

In just two years since introduction, **RYKON** Grease has stepped in to deliver lubrication in hundreds of applications where other greases have failed

The reason RYKON Grease can perform under conditions that cause other greases to fail is this: RYKON Grease has a unique non-soap, organic thickener. This thickener holds the oil between its fibers better than any other gelling agent. The thickener is able to withstand extremely high as well as low temperatures. It resists chemical action and remains stable under conditions of severe working and water washing. RYKON Grease has exceptional anti-rust properties.

RYKON Grease's unique properties make it truly multi-purpose. This leads to many worthwhile economies. With one grease to do possibly every grease lubrication job in a plant, there's no chance for application mistakes. Inventory and handling of many single-purpose greases is reduced or eliminated. Maintenance training and supervisory follow-up is greatly reduced.

More facts about RYKON Grease are yours for the asking. Call the lubrication specialist in your nearby Standard Oil office in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Illinois.**

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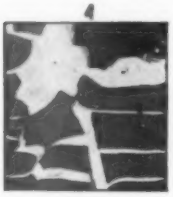


In the metalworking industry, where higher speeds, loads, temperatures and pressures are being put on bearings as a means of increasing productivity of equipment, a new type of grease has been needed. RYKON is that grease. Here are just 6 examples of how RYKON Grease has performed in tough spots:

Industry	Equipment	Type of Bearings	Conditions	Remarks
Metalworking	bearings over molten pot	—	high temperature	Temperature reaches 500° F. at times. RYKON stays in longer.
Steel Mill	pit crane, floor crane, charging car	plain and anti-friction	high temperature	Lasts twice as long as some other greases used.
Metalworking	drill head multi-spindle	anti-friction	heavy load	Other greases failed. Running cool on RYKON. No leakage.
Auto Manufacturer	switches on machine tools	—	wet	Good water protection and dielectric strength at a lower cost than previously.
Die Caster	die cast machines	various	high temperature	Cut down wear considerably.
Bearing Manufacturer	high speed spindle bearings	anti-friction	high temperature, heavy load	Lasts twice as long as a high priced bearing grease. Does not darken or form varnish.

You expect more from **STANDARD** *and you get it!*

Oven test shows high temperature performance of RYKON Grease. 1. Metal panel coated with RYKON and placed in oven at 350° F. 2. Same panel after five days. RYKON is still soft and ready to lubricate. 3. Another high-melt grease ready for same test. 4. Same panel after oven test. Grease has failed completely.

Because this has what it takes...

The rugged durability and extra value (Timken tapered roller bearings in every wheel, spring loaded non-kicking handle, slide planes for easy pallet entry and 360° lifting radius as standard) of the REVOLVATOR Red Giant hand lift pallet truck (above) has built a reputation which means that...

Red Giant Hand Lift pallet truck

We were called on to do this...

Explosion-proof High-lift Go-Getter

One of six basic models . . . REVOLVATOR Series 54.00 Go-Getter for use in explosion hazardous areas for chemical and related companies with Class I Group D or Class II Group G hazards designed at the request of one of the country's leading safety authorities. This electric lift truck meets requirements for both hazards and utilizes screw type housings hydrostatically tested to pressures far beyond those required. Additional safety feature—hydraulically operated disc brake.

Therefore: Whether you need a standard piece of material handling equipment or specially designed equipment, call on

REVOLVATOR CO.

8761 TONNELE AVENUE, NORTH BERGEN, N. J.

POINT-OF-USE STORAGE

Begins on page 144

one kind of component that's a natural for P-O-U storage. It's a material, subassembly, or part with the following characteristics: used or converted continuously; small; stored compactly; long shelf life; small intrinsic value. When you start to use P-O-U storage you can begin with components that fill those specifications.

But you can add components to the list as other plants have done. Putting it another way, you can use P-O-U storage if none of your components fits those requirements. The question is not what type can be stored at the point of use. The test question is: *How* can any given component be stored advantageously at the point of use? Answering the question requires some thought and analysis. That means work. But when you have an answer, you also have an improvement in the operation of your plant.

To help you answer the test question, here is a checklist:

What can be gained by moving this component from central stores to P-O-U storage?

1. How many times is the material handled now between receiving and first operation?
2. How mueh handling can be saved by moving it directly from receiving to point of first use?
3. What are the losses due to extra handling?
4. What delays and inconveniences in production are due to storage away from the area of use?
5. How much plant floor space can be gained?

How can the material be stored at the point of use?

1. Would receipt in a different handling unit—container, pallet, etc.—aid P-O-U storage?
2. Where is the space to store it at the point of use? (Don't overlook space overhead and under the bench as well as on the floor.)
3. Would pallet racks, bins, overhead conveyors, inclined roller conveyor racks, vertical conveyors, or some other device facilitate storing at point of use?

If the material has "take-home appeal" for workers, how can pilferage be avoided?

Turn to page 154

For more facts Circle 531 on Reader Service Card

For more facts Circle 532 on Reader Service Card ➤

CALL THE TRUSCON MAN...

Be sure you're getting your money's worth out of your plant painting program

The most economical way to paint your plant is to be sure that every paintable surface is coated with the type of paint that will stay there *longest*.

There is no one type of paint that is good for all surfaces. It's a real science to formulate coatings for different types of surfaces — and you can take advantage of Truscon's half century of experience at absolutely no cost to you.

Call the Truscon man. He'll survey your entire plant and make a detailed report to you — proving whether your plant is getting all the protection you're paying for. If any surface, inside or out, is not properly protected he will give you a written specification for 100% protection — without obligation.

Truscon coatings have protected plants of all sizes in all parts of the country for 50 years. Names of well-protected Truscon customers will be supplied to you upon request.

See the yellow pages of your telephone directory for the Truscon factory branch nearest you. Or write Truscon Laboratories, Detroit 11, Michigan.

the "cheapest" way to paint is to use the best paint ...it stays on longer

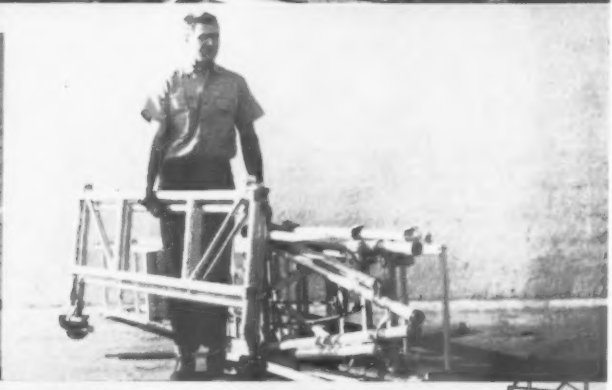
TRUSCON *Laboratories*

Industrial Maintenance Division of Devoe & Raynolds Co., Inc.
Detroit 11, Michigan

UP-RIGHT ANNOUNCES

TALLESCOPE ...telescoping aluminum work platform for overhead spot maintenance

Lightweight, rapidly assembled by one man. Extends instantly for reaching heights up to 30 ft. Adjustable legs for uneven floors or stairways. Only 29" wide for rolling through congested areas.



Telescopes and folds down to roll through doorways, under trusses, pipes and conveyors.

Separates easily into 3 components for convenient storage or transportation.

FOR TALLESCOPE CIRCULAR
WRITE TO
UP-RIGHT SCAFFOLDS
DEPT. 178 • 1013 PARDEE ST., BERKELEY, CALIF.

MANUFACTURED BY
UP-RIGHT
SCAFFOLDS

For more facts circle 533 on Reader Service Card

Clock assembly work steps along quickly with Gardner-Denver 12E air screw driver.

TIME TO TALK TIME-SAVING

Gardner-Denver believes there's no substitute for men—it has been our philosophy of growth for 100 years. Your Gardner-Denver air tool specialist has helped many uncover ways to speed the production pace . . . lower costs. He's a good man to know.

How high-speed air tools save clock assembly time

This manufacturer uses air power to put clock assemblies together in a hurry. The main spring in this high-speed production: Gardner-Denver air screw drivers. At a touch screws spin tightly to preset torque . . . a cushion clutch eliminates runaway bits and over-torquing. In seconds the operator is ready for the next assembly.

Leading manufacturers everywhere keep production in time with air tools—Gardner-Denver drills, screw drivers, nut setters, ratchet wrenches, multiple drilling and fastening machines. They're fast, safe, easy to operate. Write today for air tool bulletins.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

"THIS LUBRICANT SAVES 7 TIMES ITS COST IN PRODUCING SHOES"

says: WOLVERINE
Shoe and Tanning Corp.

"We use LUBRIPLATE No. 100 for lubricating the chains that drive the paddle wheels which turn hides immersed in solution. The solution is sometimes acid, sometimes caustic. Until we tried LUBRIPLATE, chain life was only about one year. After a two year test, applying LUBRIPLATE to the chains every two weeks, it appears that for every dollar we invested in LUBRIPLATE, we have saved seven dollars in chains!"

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE GREASE AND FLUID TYPE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

LUBRIPLATE is available in grease and fluid densities for every purpose . . . LUBRIPLATE H. D. S. MOTOR OIL meets today's exacting requirements for gasoline and diesel engines.

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

POINT-OF-USE STORAGE

Begins on page 144

1. Is it feasible to keep the material under lock and key for absolute protection?
2. Can responsibility be pinned down and controlled?
3. Can material be changed to destroy its personal usefulness?

Can purchased or manufactured lot size be reduced to facilitate P-O-U storage of each order?

1. Is there sense in storing a portion of each order at the point of use, and the rest in the storeroom? (Some plants do this.)

Can the principle of P-O-U storage be applied to materials in process? (Reliance Electric picked up nice gains on this one.)

1. Are some materials in process now stored in two or even three places—point of completed operation, storeroom, and point of next operation (the point of use)?

Can the inventory be controlled if the material is stored at point of use?

1. If the same item is needed at more than one point of use, can a supply be kept at all points?

HINTS ON P-O-U STORAGE

There's only one place to put a P-O-U storage facility. It has to be at the point where the material is used or you don't have P-O-U storage. And the closer the better. Best place for storage of components is within reach. Actually, a compromise might be acceptable. Some walking after materials might be all right if the over-all pluses and minuses add up to a saving. Chances are good, however, that you'll get nowhere with a proposal that slows production.

Reliance Electric is doing a clever thing in adapting P-O-U storage to its job-shop operations: It will move two assembly operations into the storeroom (illustration, page 144). It doesn't appear practical to store supplies at the point of assembling Seal Pak electronic circuit units and harness units where they're located in manufacturing. So they'll be relocated within the storeroom. The storeroom will become a P-O-U storage for supplies, and a stockroom for output.

Turn the page

ADAMS FACT FILE #2

PLANT AIR

Moisture Chief Cause of Trouble . . .

Every company today is looking for ways to offset the increased costs of labor, material, equipment and services. At a gasoline station you expect "Free Air", but in industry it is a major expense. Perhaps in your own plant, for an investment in a few minor compressed air system alterations, significant savings are possible.

Water, sludge, rust, oil and dirt in compressed air systems are prime causes of maintenance and production down-time. Water vapor condensing in air lines tends to corrode the piping. Also, water present in the piping may freeze during winter, causing serious reduction of compressed air supply. Such restrictions are often difficult to locate and thaw. This same line moisture may emulsify lube oil destroying its lubricating value and the resultant mixture has high fouling characteristics. Frequently, ice will form within the tool itself since expanding air cools the moisture . . . tool efficiency will be seriously affected.

Some of the Other Problems Created By Wet Compressed Air . . .

Wet compressed air is not only a construction and production tool problem. Faulty paint jobs, contaminated chemical and food products can often be traced to moisture laden compressed air. Waterhammer, unequal pipeline thermal expansion and line leaks also result from collected moisture. In addition, air lost through traps, and in blow-down of compressed air lines provide no useful work . . . represent a sizeable power loss.

You Can Lick Compressed Air Moisture Problem . . .

All of these hidden costs can be virtually eliminated by the installation of an Adams Aftercooler and Cyclone Separator between the compressor and receiver tank. By cooling discharge air to within 10° F. of cooling water temperature — guaranteed with Adams standard Aftercoolers — the moisture can be removed at the separator. Pressure loss is less than one-half pound on these units including the separator. In severe cases, moisture removal of over 90 per cent can be obtained by cooling the air with Adams 2° Aftercooler to within 2° F. of water temperature.

Air Filter for Final Protection at Point of Use . . .

As an added safeguard for expensive tools and equipment, an Adams Poro-Stone Air Filter should be installed just before the air is used. These filters remove all solid material picked up by the air stream. With an Adams Aftercooler, Cyclone Separator and Air Filters clean, dry, trouble-free air is supplied to your production tools. You get continuous service with minimum maintenance.

For further information on how the complete line of Adams air equipment can solve your compressed air problems, write today for your free copy of Bulletin No. 712 on Aftercoolers and Bulletin No. 117 on Poro-Stone Air Filters from the R. P. Adams Company, Inc., 215 East Park Drive, Buffalo 17, New York.

Circle 535 on Reader Service Card
Circle 536 on Reader Service Card

SAFETY SWITCHES STAND UP UNDER 100,000 AMPERE SHORT CIRCUIT TEST!

INDEPENDENT TESTING LAB RELEASES FINDINGS AFTER GRUELLING "TORTURE RACK" TESTS

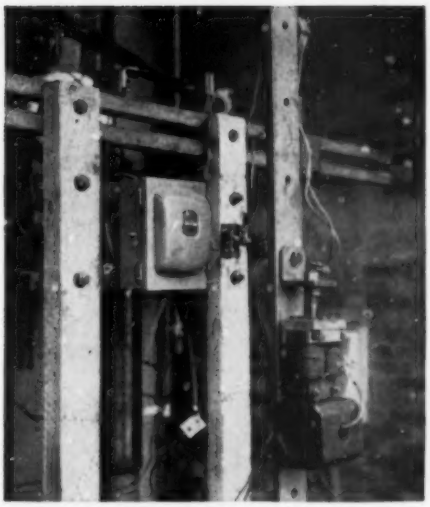
Unprecedented tests have been completed on 30 through 600 ampere rated Square D safety switches equipped with high capacity current limiting fuses. During these tests, switches were closed on a short circuit system delivering up to 100,000 amperes (symmetrical—R.M.S.). In addition, the fault was applied on the closed switches. *All switches withstood the shocks without any sign of failure!*

High Capacity Systems Demand Stamina

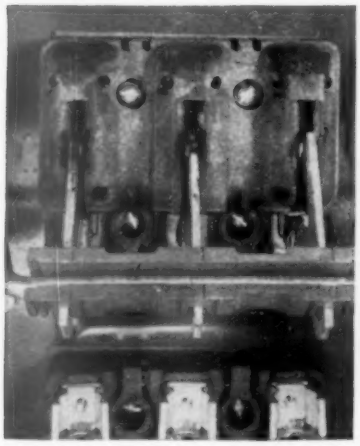
High capacity systems capable of delivering tremendous short circuits are becoming more and more prevalent with the growth of electrical loads. Network systems in metropolitan areas are a source of such faults. Another, the heavy industrial areas, with a concentration of sub-stations and rotating machinery. Terrific stresses and heat generated by such faults are serious hazards to both personnel and equipment unless properly contained. That is why proven protection for switching service and feeder circuits is of major concern.

Square D Standard Switches Do The Job

These tests offer conclusive proof that standard Square D Type HD and Type ND switches, equipped with high capacity current limiting fuses, can be used on such systems without fear of failure. You pay no premium for the proven performance they offer. Why settle for less?



Square D switch on "torture rack" during test involving up to 100,000 ampere short circuit



SUMMARY TABLE • Extract from Report No. 5/NA R66—Sheet No. 5

Ampere Rating	Voltage Rating	Catalog Number	Average Symmetrical Prospective Current R.M.S.	Recovery Voltage R.M.S.	Maximum Total Arcing Time	Fuse Type
30	250	A85351	96,600	252	.0009	A2Y-30A
30	250	A85351	96,400	253	.0010	FRN-30A
30	600	A85341	107,000	590	.0020	A6Y-30A
30	600	A85341	106,000	601	.0027	FRS-30A
60	250	A86352	96,400	248	.0010	A2Y-60A
60	250	A86352	95,200	252	.0019	FRN-60A
60	600	A86342	106,000	605	.0011	A6Y-60A
60	600	A86342	108,000	598	.0020	FRS-60A
60	600	A86342	107,000	601	.0013	NAS-60A
100	250	A86353	95,200	253	.0009	A2Y-100A
100	600	A86343	108,000	604	.0014	A6Y-100A
200	250	A86354	95,200	253	.0037	A2Y-200A
200	600	A86344	107,000	602	.0011	A6Y-200A
400	250	A86355	95,900	252	.0039	A2Y-400A
400	600	A86345	106,000	611	.0050	A6Y-400A
600	250	A86356	94,500	251	.0062	A2Y-600A
600	600	A86346	107,000	601	.0062	A6Y-600A

Above • Extract of Nelson High Power Laboratory Report C/NA-66

At left • No sign of failure in this switch interior after 100,000 ampere short circuit test

SQUARE D SAFETY SWITCHES GIVE YOU *Certified* PERFORMANCE!

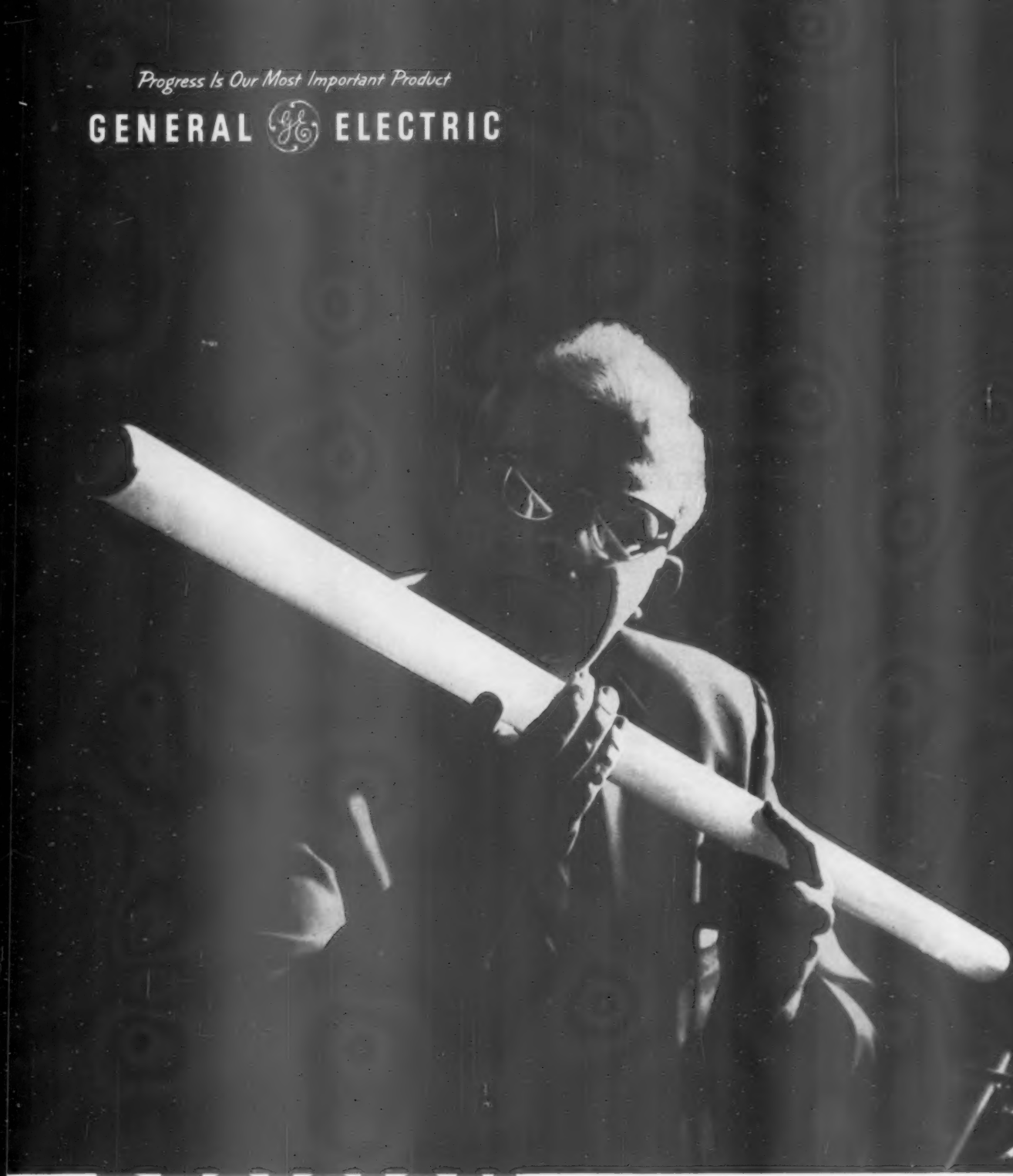
SQUARE D VISIBLE BLADES you can SEE you're safe!

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

Progress Is Our Most Important Product

GENERAL ELECTRIC



DECISION

"Alone . . . just me and my question . . . which lamps to buy. All look about alike . . . but I keep remembering what past experience has proved to us about General Electric Lamps. That 999 out of 1,000 are sure-starters . . . and 99 out of 100 will still be burning in 1961. And happy thought! We pay less for a case of G-E Fluorescent Lamps today than we did in 1950!"

DECISION: "Why gamble on performance when I can get G-E Lamps at little or no premium in the purchase price."

General Electric Co., Large Lamp Dept. C-905, Nela Park, Cleveland 12, O.

For more facts Circle 538 on Reader Service Card

POINT-OF-USE STORAGE

Begins on page 144

Goals for storage—How you store is just as important as where you store. Just try to spread everything on the floor, and it's ten to one P-O-U storage won't work. Why? Because you're using too much space—probably even more than central stores would give the materials.

In P-O-U storage you must meet four objectives:

1. Make materials handy to get.
2. Use minimum floor space.
3. Avoid blocking production.
4. Protect materials from damage or loss to the extent needed.

As in many problems, the objectives tend to be at cross-purposes. And just as you solve other problems, you compromise the least with the most important.

Helps for storage—The plants studied use racks and bins to store most of the parts. Racks hold odd-shaped parts, palletized unit loads, and containers of parts. Bins are used for small part—loose and in containers.

Conveyors, too, can be used. Overhead chain and cable conveyors are commonly used to carry parts in storage. They dip down at operation points. This scheme is commonly used in high production plants. To mention just one example, the Motorola plant uses this method in manufacturing television picture tubes.

Power-and-free monorail conveyors fit into P-O-U storage nicely. Power sections carry components between operations, free sections store them at the points of use. This type of conveyor is adaptable for job shop operations as well as mass production.

The use of gravity roller conveyors in tiers for P-O-U storage is growing. This idea is especially useful for job shops, but used in high production plants, too. Conveyor sections, arranged like racks—sections side by side and one section above another—are as long (or as short) as needed. Materials are fed into the conveyor rack from the back, taken out at the front. Materials move by gravity toward the front because the conveyor sections are inclined in that direction. Advantages include first-in, first-out

PAYLOADER® versatility

with hydraulic grapple

Substitute this Hydraulic Grapple attachment for its bucket and your "PAYLOADER" tractor-shovel can handle many kinds of loads other than bulk, granular materials. Light metal scrap, bales, bundles, drums and many other unit loads can be picked up and moved fast and safely by means of this exclusive "PAYLOADER" attachment.

The powerful grip and lift of the grapple combined with the traction of the "PAYLOADER" digs deeply into tangled piles of bulky scrap to break out heaping loads. Positive hydraulic kick-off device provides complete dumping of such loads.

Independent hydraulic power on each grapple arm insures a firm grip on odd-shaped loads.

Other Attachments that multiply the versatility of a "PAYLOADER" and are quickly and easily interchanged with its bucket are fork lift attachment, detachable "Payhopper" bucket on casters, pick-up sweeper, open or tine-type buckets.

There are "PAYLOADER" tractor-shovels in several sizes and types with carry capacities from 2,000 to 9,000 lbs. for all kinds of bulk-handling work, indoors or outdoors. See your Hough Distributor for complete details.

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☐ Send "PAYLOADER" grapple data
☐ Data on "PAYLOADER" models

Name _____ Title _____

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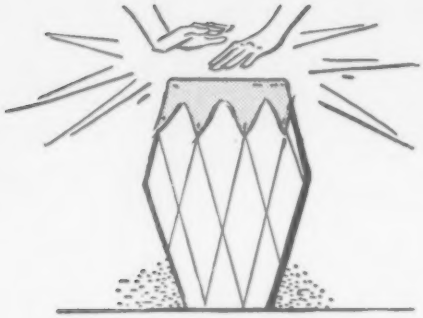

There's no "Bongo" sound on

BORROUGHS

STEEL WORK BENCHES

BORROUGHS

OF KALAMAZOO

STEEL **SHOP EQUIPMENT**

One of the features of Borroughs steel work benches is their noise-repellent top. Compound steel channel reinforcements not only provide extreme ruggedness, but at the same time achieve an unusual reduction in "drum" effect. We could list many more outstanding features of Borroughs work benches besides their remarkable rigidity and their easy adaptability to many different work bench and table combinations with Borroughs accessories. But the best way for you to get all the facts quickly is to write to Borroughs today. Borroughs steel shop equipment line also includes tool stands, utility carts, shop desks, tables, portable and semi-portable work bench kits, and other shop equipment accessories.

SEND FOR CATALOG

BORROUGHS MANUFACTURING COMPANY
OF KALAMAZOO

A SUBSIDIARY OF THE AMERICAN METAL PRODUCTS COMPANY OF DETROIT

3020 NORTH BURDICK ST. amp® KALAMAZOO, MICHIGAN

Begins on page 144

inventory turnover; separation of different materials; non-interfering stocking; easy access; and saving of floor space.

The whole point of using equipment for P-O-U storage is to work out the best compromise of objectives. Selection is important. But there are no pat answers. Imaginative but practical thinking is needed to set up facilities to make P-O-U storage work advantageously at each point. Sometimes custom equipment best solves the problem. For example, FMC's Ordnance plant cut small steel drums in half, nested them on their sides in tiers to form a rack of bins for small forgings, castings, etc.

Another approach to simplification is design of the handling unit. Ford's Lincoln division feels this is just as important as storing at the point of use to cut handling costs. It tries to get materials shipped in a "package" that can move directly into a P-O-U storage unit. The forms of the unit include palletized unit loads, specific carton sizes, and returnable hanger-racks.

P-O-U storage areas generally are not enclosed. Reliance Electric points out that enclosing would defeat convenience. Materials in P-O-U storage are intended to be accessible to all who need them.

There are exceptions to the no-fence rule. Items likely to be stolen have to be guarded. For example, Lincoln locks up auto radios at point of use. Another plant (not one of the ten surveyed) locks up silver wire where it's cold-headed into parts. The operator gets a key and a stock check daily.

Materials with a high pilferage potential can be as safe in P-O-U storage as in central stores. They're vulnerable to loss in in-between transportations and at operations as well as in storage. Cutting the number of moves reduces the risk.

HOW P-O-U IS USED

None of the ten plants studied use P-O-U storage 100%. Only the auto assembly plants—Chrysler and Lincoln—and Delco-Remy's battery plant are practically 100%. They say 99%. Automatic Electric is

For more facts Circle 540 on Reader Service Card

For more facts Circle 541 on Reader Service Card ➤

Do you know how much floor maintenance costs industry? As close as can be approximated, floor maintenance takes 16%* of the maintenance dollar—and all maintenance costs industry approximately 16 billion dollars annually. Let's be more specific—figure out how much floor maintenance costs your company:

Enter here your annual maintenance costs _____ **×16%*** = _____ This is the figure that can be reduced by using Sol-Speedi-Dri

**Approx. % of maintenance spent on floor upkeep*

You can cut that sum by using a good floor absorbent—one that absorbs and holds all liquids off the floor surface. Sol-Speedi-Dri is a *good, safe* floor absorbent because it has *powerful holding* power. It extends floor life and saves costly repairs and resurfacing... and it makes floors more slip-proof by keeping its hard granular shape . . . it's the most dust-free absorbent made. This can be easily demonstrated.

Look in the Yellow Pages under *Absorbents* or *Oil and Grease Absorbents* for your nearest Sol-Speedi-Dri distributor. Large, free sample of Sol-Speedi-Dri for the asking—no obligation.

USE A GOOD MINERAL FLOOR ABSORBENT

SOL-SPEEDI-DRI

SPEEDI-DRI DIVISION / MINERALS & CHEMICALS CORPORATION OF AMERICA, MENLO PARK, NEW JERSEY

Cut and Thread Pipe by Hand?
...not me or my men when I can get the new tough fast little
RIDGID 300
Power Drive
For Only $199.50
*Subject to change without notice.
Weighs only 79½ lbs. —all metal!
Pats. Applied For
Full Speed...
even on 2" pipe or conduit
This new 300 is clear out of its price class! Its RIDGID-built motor has extra power and extra-long brush life . . . heavy-duty bump-proof switch . . . RIDGID Speed Chuck with guaranteed tight grip, forward, reverse, replaceable jaw inserts and all-metal hand wheel . . . 2 extra-strong tool support bars . . . and a lot of other features that make it far the most for your money. You can't afford to be without it—see and try the new 300 at your Supply House!
No. 1206 Stand for RIDGID 300
*Price $27.00
The Ridge Tool Company
Elyria, Ohio, U.S.A.
THREADED PIPE . . . It's Tight . . . It's Best . . . Costs Less!

POINT-OF-USE STORAGE

Begins on page 144

probably close to that in telephone assembly. White Motor estimates 80%, FMC's Ordnance plant about 70%. There are no estimates for the others. But none are anywhere near 100%, some a long way from it. Point is, you can take advantage of the benefits in P-O-U storage without going all the way.

Most of the plants operate a central storeroom, although it's smaller than before adoption of P-O-U. The central storeroom is used for two purposes:

- Storage of materials that are not included in the P-O-U set-up.
- Storage of P-O-U supplies over and above what's assigned to P-O-U storage.

Supply quantities at points of use vary. Burroughs Corporation (Detroit) limits assembly supplies at points of use to five days. Manufactured parts are kept at 10-day supply quantities in operating centers, cut in half during the past year.

Ford's Lincoln plant divides materials into four categories. "A" category includes motors, transmissions, heavy stampings—anything that is both bulky and costly. The plant tries to maintain three-day stocks of these near assembly points. Tires, batteries, and instruments are examples of "B" items. A 10-day supply is kept at point-of-use. "C" items are minor stampings. P-O-U stocks vary from 15 to 30 days, depending upon shipping frequency and container size. "D" items fall into the nuts-and-bolts category. For these there's a small central parts room for a 30-day back-up stock. A three-day supply is kept on the line at point-of-use.

These are fast-moving operations. Other plants, particularly the job-shop types, keep supplies at points of use for longer periods.

Where components are heavy, handling equipment has to be provided at the point of use. The plants aim to place materials in P-O-U storage in a way that avoids re-handling. The idea is to place components so they can be put into use without a lot of unpacking, or sorting or moving other materials to get to them. Reliance Electric stores its larger control panels on wheels (individually mounted) at the point

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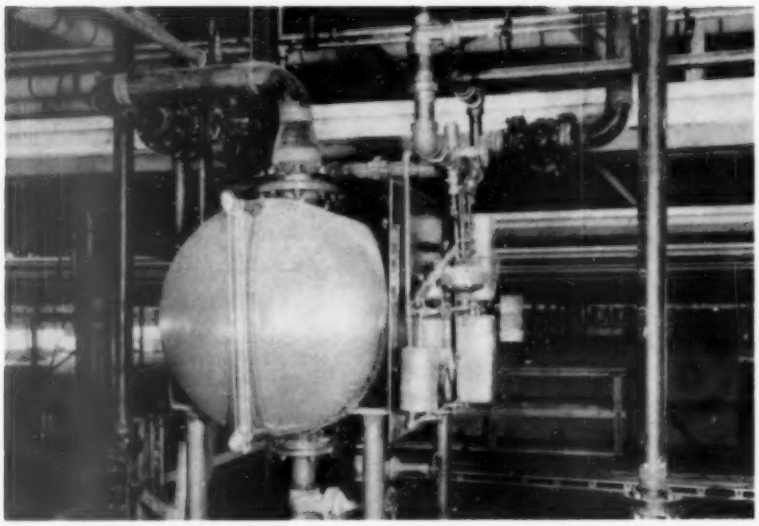
BYERS GUIDE

Maintenance and Operating Tips from A. M. Byers Company



One of two batteries of condensate pumps installed in each of five similar buildings at General Electric Appliance Park, Louisville, Ky. To protect against damage from steam condensate corrosion, Wrought Iron Pipe has been installed for the return lines within each building and to the area's central boiler plant.

Seven Ways to Minimize Maintenance In Steam Condensate Systems

While selection of the right piping material precludes virtually all other factors in controlling condensate corrosion, additional service life can be squeezed from your existing system by following these helpful suggestions:

1. The feed water deaerator should be operated at or near boiling point, and should be maintained in an efficient condition.
2. All joints in return lines operating under sub-atmospheric pressures should be made airtight.
3. All horizontal return lines should be given sufficient slope or pitch to permit rapid and complete drainage.
4. All low points or pockets in the lines where condensate can collect should be eliminated or properly tapped.
5. Reaming of pipe ends to remove burrs is particularly important in condensate lines.
6. Cold water injection into return lines ahead of vacuum pumps should be avoided wherever possible.
7. Extra heavy nipples should be used in return lines.

Practically any application where steam condensate is conveyed through pipe is a "natural" 4-D Wrought Iron application. Here are two reasons why:

1. Ordinary metals corrode quickly and become costly maintenance headaches. Alloy steels increase initial costs greatly.
2. 4-D Wrought Iron's corrosion-blocking film forms around the interior wall of the condensate line enabling the pipe to give long, maintenance-free service.

Incidentally, since the right piping material means so much to service life in steam condensate systems, you may wish to contact our Engineering Service Department staff. They maintain records and data spanning 60 to 75 years which show how long various materials endure in steam condensate service.

How D.L. Clark Co. Cuts Maintenance Costs 50%

"Because of the excellent service life of 4-D Wrought Iron Pipe in the plant, fewer pipe fitters and helpers are needed," says the mechanical superintendent at the D. L. Clark Company, Pittsburgh, Pa.

Here, at the home of the famous Clark candy bar, 4-D Wrought Iron Pipe, one-half inch to six-inch sizes, and 4-D Wrought Iron nipples are kept in stock. This pipe material is used for steam lines, condensate return lines, air lines, hot and cold water lines, and chocolate lines.

Mr. Robert Dunbar, the plant's mechanical superintendent, credits 4-D Wrought Iron with cutting maintenance costs approximately 50 per cent in his operation.

4-D Wrought Iron proves especially effective at the Clark Company against that old bugaboo, condensate corrosion. Let's review the nature of this nemesis for a minute. After steam loses its heat, it turns to moisture, which is distilled water greedy for gases. Any gas in the steam is readily absorbed into the condensate as it is cooled. The condensate becomes violently corrosive, depending upon the percentage of free CO_2 plus O_2 contained in the steam. Becomes downright costly, too, if allowed to rampage. 4-D Wrought Iron doesn't let it.

A Forging Tip or Two

In order to forge 4-D Wrought Iron successfully, it is necessary to heat it to at least 2300°F., and stop working it when it reaches a temperature of 1750° to 1800°F. At 2300°F., 4-D Wrought Iron gives a greasy heat. From 2500° to 2600°F., it will sweat.

Higher temperatures are essential in forging 4-D Wrought Iron because of its low carbon content. 4-D Wrought Iron with its low carbon content will take much more heat without burning than other materials with higher carbon. At the right temperatures, 4-D Wrought Iron is a cinch to work and form.

BYERS GUIDE

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How to Dry Sand With No Piping Downtime

Norton Company, Worcester, Mass., has a tough assignment for heat exchanger tubes: in a sand drier that removes moisture from the abrasive materials used in grinding wheels, refractories, laboratory ware, non-slip tile, and other products. The tubes, which carry steam or hot water, are housed in a rotating shell filled with the sand.

Tubes in this service are subject to the punishing corrosive action of the moisture in the sand as well as the abrasion of the sand as it rushes over the coils. The inside walls of the tubes are also subject to corrosive action because of the condensate they carry.

Water or moisture in the sand usually has a chloride content. And 4-D Wrought Iron's proven resistance to salt and brine effects provides an excellent basis for comparison in this service.

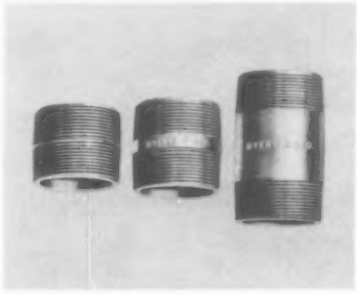
If corrosion or abrasion is playing hob with your piping coils, it could be you're using an inadequate piping material. Maybe it's time you investigated the advantages of 4-D Wrought Iron.

Right Pipe, Wrong Nipples, Premature Failure

In a steam condensate line installation in North Carolina, specifications called for wrought iron pipe to be used. Steel nipples, however, were selected for this corrosive service.

Within three years, the steel nipples began to fail. They were replaced with wrought iron nipples, and the steam condensate line has experienced no trouble since. Therein lies an object lesson.

4-D Wrought Iron nipples, preferably extra strong, should always be used in *any* piping system because the majority of failures occur at joints which should really have *extra* protection.



Identification is important, too. Here's how to be sure you get what you order. Byers 4-D Wrought Iron nipples, other than close nipples, are machine stamped with the word BYERS and STD for standard weight, or X STG for extra strong pipe. Close nipples bear a red band around the center. Couplings up to and including 14″ are stamped with a "B" within a keystone. If you want durability—all the way down the line—insist on 4-D Wrought Iron nipples.

WHAT IS "4-D"?

Note: New 4-D Wrought Iron was achieved by substantially increasing the deoxidation of the base metal, slightly increasing the phosphorous content, and using a more siliceous iron silicate. Result is increased corrosion resistance, improved mechanical and physical properties.

Literature Available

Literature described below is available on request. For information on specific applications, write Byers Engineering Service Department.

New four-color booklet, **4-D Wrought Iron: A New Dimension in Corrosion Control,** discusses in detail Byers' latest product development. Includes a test section which is graphically illustrated and shows comparative corrosion resistance of 4-D Wrought Iron, standard wrought iron and other ferrous metals.

Information on facts affecting corrosion, comparative service records, and suggestions for minimizing maintenance are presented in our special report: **The Use of Wrought Iron in Steam Condensate Lines.**

Complete mechanical data on all Byers pipe and tubular products are available in the **Byers Pipe Catalog.** Discusses differences between 4-D Wrought Iron and steel. Includes specifications, pipe standards and measurements.

New ten-page bulletin, **Cold Drawn Wrought Iron Heat Exchanger and Condenser Tubes,** cites actual installations in which the use of 4-D Wrought Iron and other metal tubing in the same equipment permits service life comparisons. Lists cost-per-foot-per-year figures for each material and the corrosive conditions present.

For additional information on 4-D Wrought Iron, contact Byers Division Offices in the cities listed below.

The maintenance and operating items appearing in BYERS GUIDE were prepared by the Engineering Service Department of

A. M. BYERS COMPANY

Pittsburgh 22, Pennsylvania

ATLANTA • BOSTON • CHICAGO • HOUSTON • NEW YORK • PHILADELPHIA
PITTSBURGH • ST. LOUIS • SAN FRANCISCO • WASHINGTON, D. C.

4-D Wrought Iron is immediately available and may be obtained through established distributors of Wrought Iron Pipe. Plate, bar, and other flat rolled products may be ordered direct.

Corrosion costs you more than Wrought Iron

POINT-OF-USE STORAGE

Begins on page 144

where they enter assembly. The Lincoln Motor plant also uses wheeled racks to facilitate handling in P-O-U storage.

SOME CONTROLS NEEDED

Several plants point out that a disadvantage of P-O-U storage is possible loss of accountability, because control of is transferred from stores-minded people to production-minded people. So an inventory control system is important. Without it, P-O-U storage won't work.

All ten plants surveyed use a system including records of inventories combined with ordering and expediting balance points. P-O-U storage can be used with any good materials-control system.

In addition, physical checks are used—formal and informal. Lockheed, for example, has two forms of inventory checking:

- Once a week a control man checks each bin by sight. He compares contents with quantities marked on a 20-day forecast sheet. If the bin looks low, he counts the parts manually. If the supply is below minimum, he reports a shortage.
- Every 40 to 60 days a control group visits each P-O-U center, counts each part number on hand, adjusts inventory records.

FMC makes physical counts monthly, quarterly, semi-annually, or annually, depending on the loss probability. Also FMC has central stores employees check stocks informally throughout the plant regularly and to alert material control if any stock appears low.

Delco-Remy checks monthly.

Burroughs divides items into four categories, based on daily dollar usage. "A" items ($10 or more) and "B" items ($7.50 to $9.99) are counted monthly. "C" items ($1.50 to $7.49) semi-annually, "D" items (remainder) annually.

Motorola counts everything in P-O-U storage once a year. But it makes spot checks during the year to keep everyone on his toes and checks inventories six weeks ahead of the ends of model runs.

All plants report pilferage is not a significant problem. Attractive parts are specially protected in P-O-U or central stores. **END.**

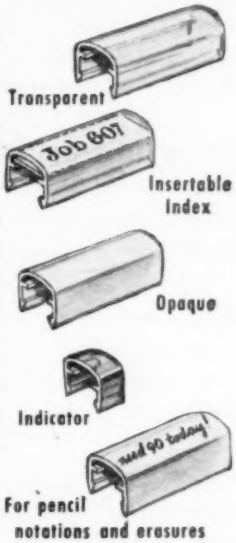
ALMOST UNLIMITED APPLICATIONS

ACME VISIBLE

VISUAL CONTROL PANELS

Chart Action, Indicate Trends, Show Results, Permit Comparison, Picture Organized Facts for Analysis and Decisions.

OVER-RIDING SIGNALS



TUBE INTERIOR SIGNALS

Panels Contain 25, 50 or 100 Tubes Available in 17, 30, and 40 inch widths

Complete flexibility with limitless signalling and charting possibilities . . . Easily adapted to your individual record requirements.

Lightweight panels contain clear plastic tubes which are individually removable and may be shifted from one position to another . . . Clarity of tube provides full legibility of contents.

Signals snap on or off at any point . . . Hold position until positively moved . . . Slide smoothly back and forth . . . By-pass freely.

Insertable index feature affords triple signalling potential: by position, by color and by legend of index.

Ask the man from Acme to show you examples—

ACME VISIBLE RECORDS, INC. CROZET, VIRGINIA

☐ Send us more information on Visual Control Panels.
☐ We are interested in Acme Visible equipment for _____ records.
KIND OF RECORD
FM-259
☐ Have representative call. Date_____
Time_____
Company_____ Attention_____
Address_____
City_____ Zone_____ State_____

FACTORY

IDEAS OF THE MONTH

By LEWIS K. URQUHART, Consulting Editor

(For more information, circle item numbers on Reader Service Card next to back cover)

How safe is safety clothing? New tables (*Milburn*) show how Dynel, Orlon, Dacron, Acrilan, vinyl-coated fabrics, vinyl and polyethylene films stack up under 20-hour dunking in acids, alkalies, salts, and solvents in varying concentrations and at varying temperatures. **(291)**

If floodlighting is on your 1959 agenda, don't make a move until you've received and read your copy of a brand-new catalog (*Crouse-Hinds*)—especially the valuable section on how to select floodlights. **(292)**

No dozing for night watchmen equipped with Driver-Larm (*Wright Airborne Electronics*). When head nods, glob of mercury closes transistorized circuit, sounding buzz in wearer's ear—and putting Morpheus to flight. **(293)**

For your parking lot, Jet-Dri (*Consolidated Chemical*) is a long-lived traffic paint that dries in a few minutes to a tough, wear-resistant finish. White, yellow, red, black, green, aluminum. **(294)**

Take data-processing problems to CEIR (*Corporation for Economic & Industrial Research*), which will rent you an IBM 704 or 709, also peripheral equipment, by the hour; provide programers, analysts, mathematicians by the day; train your personnel in computing and programing techniques. **(295)**

Kolorkoded luminaires (*Guth*) are (you guessed it!) really color coded—to protect and to guide employees. Secret: colored side windows. *Green for go*—to identify general aisles, traffic lanes, walkways; *yellow for caution*—stairs, deadends, tripping hazards, dangerous areas; *red for stop*—exits, fire extinguisher locations, hose outlets, etc. **(296)**

Who's in? who's out? An in-and-out register (*Heirloom*) at your switchboard keeps accurate score. Works from both sides. **(297)**

Buyers' guide for stainless steel products and services (*American Iron & Steel Institute*) lists in its 159 pages some 3000 companies that make stainless steel or offer services pertaining thereto. **(298)**

Wonderful little (7½ lb.) recorder-transcriber announced a year ago (*American Geloso Electronics*) is celebrating its first birthday with a full-year guarantee from date of purchase—at no increase in price. **(299)**

Neat plastic ties (*Westinghouse*) will help unfurrow the brow of any production man who would like to bind wiring harnesses better and faster. Ratchet-like design makes ties self-adjusting to wide variety of bundle diameters. Said to reduce bundling time by as much as 30%. **(300)**

Pay-way computer shows how water coolers (*Westinghouse*) pay for themselves by reducing wasted steps, wasted time. Gives you dollar savings at a glance, tells number and type of coolers needed to make them. **(301)**

Now a nomograph (*Sandvik*) that's designed to help you figure—in a jiffy—how wide your bulk material belt conveyor should be. **(302)**

Every maintenance shop will find a dozen uses for Wireformer, a handy-dandy tool (*Vinkemulder*) that bends, straightens, and cuts wire up to $\frac{5}{32}$-in. diam. Ordinary finger pressure is all you need. **(303)**

Booklet of the month "Winning Combinations That Reduce the Cost of Chips" (*Ingersoll*), a storehouse of facts on milling and boring. **(304)**

No-lint work clothes (*Worklon*), just in case your processes call for head-to-toe coverage, are 100% Dacron, with extra-high necks, specially adjustable sleeves and pants cuffs. **(305)**

For proved lighting layouts see new technical bulletin (*General Electric*) that describes 21 lighting problems solved with Power Groove fluorescents—everything from a junkyard to fine electronic assembly. **(306)**

Monoxor is pocket-size, direct-reading carbon monoxide indicator (*Bacharach*). No electrical circuit, so may be used in presence of flammable gases. Measures length of stain in tube, eliminating color comparison and providing easy reading over wide range of lighting conditions. **(307)**

Stop costly waste of water from shower heads and save Btu.'s by installing Autoflo (*Speakman*) right in the line. Cuts flow to maximum of 4½ gpm., despite pressures up to 150 lb. per square inch. **(308)**

And stop that drip with a single-handle mixing faucet (*Gyro Brass*) which we hear is dripless. No washers, no spindles to replace, no seats to renew. Single motion controls water volume and temperature. **(309)**

Facts about aluminum in electric systems is subtitle of 36-page brochure (*Alcoa*) that covers current economics of choosing aluminum, belongs in your maintenance department's reference library. **(310)**

To meet any metallic bonding need, there's a kit (*Biggs*) containing five metal powders and a pint of clear epoxy. **(311)**

More Ideas of the Month in Press Time Report following page 54

now you can slash your

TELECONTROL*—a management tool—
Saves more than its cost in first 12 months

While management's attention has been aimed at increasing productivity of direct labor, non-productive labor costs have been climbing steadily. In some industries, the non-productive vs. direct labor ratio has almost doubled. To answer this costly management problem, Hancock Industries has developed TELECONTROL—simple, low-cost and highly effective equipment for controlling and reducing unproductive labor and supervisory costs through more efficient use of both manpower and production facilities.

Telecontrol is new, yet completely proven in several industries ranging from small companies producing hardware to giant electric appliance producers. The photo panel below explains how Telecontrol works. More important is what Telecontrol can do for management. Of the many profit-improving benefits, the main ones are:

CUTS DOWNTIME COSTS—of machines and direct labor. Telecontrol does this by letting production management "see" the operation of every machine from a central point. You can see exactly what is being produced at every point in the plant. Machine operators are shifted, without lost time, to other operations when required. Setup time is speeded. When mechanical troubles occur, Telecontrol makes possible immediate corrective action. Materials handling, too, is expedited by Telecontrol's ability to eliminate delays in supplying or removing stock.

CUTS SUPERVISORY COSTS—by eliminating unnecessary (and non-productive) time of foreman in chasing around the plant. With Telecontrol, the supervisor is at any trouble spot within seconds and can correct it without lost time.

BOOSTS PRODUCTION EFFICIENCY—by reducing idle time of production people to a minimum—and by locating and helping to identify causes of failure to maintain production standards. Yet, both machine operators and foremen are enthusiastic over Telecontrol as it makes their own jobs easier.

ELIMINATES PAPERWORK—At shift-end all production data is immediately available at a central source—and record-keeping processing is greatly

TELECONTROL, for either single or multi-shift operation, consists of only three basic elements—

. . . (left) a control and signal box at each production station (or machine) relays production information and serves as a point from which . . .

. . . (center) production supervisors, with belt-carried telephones, have direct communication with . . .

. . . (right) the control center. Here, separate panels for each production station indicate operating condition, production time, downtime, pieces produced, and balance left. An Intercom system ties in the entire plant.

unproductive labor costs

CASE HISTORY No. 1

Type of plant.....stampings
No. of machines.....200
TELECONTROL equipment cost..$70,000
1st year savings:
in unproductive labor costs....$80,000
in inventory, downtime, etc.....$20,000

streamlined for timekeeping, payroll, cost, inventory control or production-programming functions. Telecontrol reduces the paperwork of foremen and timekeepers to practically nothing.

BETTER INVENTORY CONTROL—Telecontrol, in anticipating completion of runs, eliminates overruns and underruns, permits more realistic inventory levels for greater economy. Telecontrol also helps improve manufacturing planning, and smooths out production loads in any plant of over 200 employees.

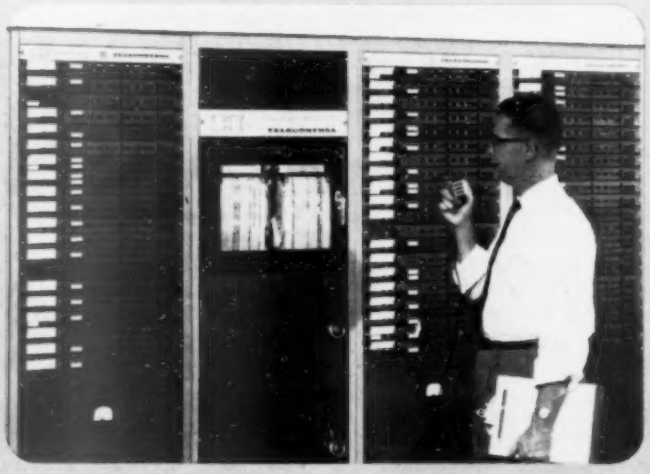
HELPS MANAGEMENT—Telecontrol equipment "brings" every operation in the plant to production management as it happens. All the information needed is readily available—now, not days or weeks later. It cuts unnecessary costs, provides accurate data and improves methods. Yet, Telecontrol equipment is inherently simple and foolproof, easily installed and serviced. It costs so little that the savings in unproductive labor costs alone will pay for it in 12 months or less. Full details on Telecontrol equipment can be obtained by writing:

HANCOCK

TELECONTROL DIVISION

HANCOCK INDUSTRIES, INC. • JACKSON, MICHIGAN

**TELECONTROL Production Control Equipment*



Industries to which TELECONTROL is readily adaptable include:

- †**Appliance Manufacturing (major)**
- †**Appliance Manufacturing (small)**
- †**Automotive**
- †**Electrical Manufacturing**
- †**Foil Printing**
- †**Paper Processing**
- Machinery, except electrical
- †**Metal Parts Fabrication**
- †**Molded Plastic Forming**
- Publishing
- Textile
- †**Tool Manufacture**

†Indicates installations already in use

By GEORGE A. HOY, JR., Industrial Management Editor, FACTORY

More Automation or Else...

Or else less leisure, said Henry B. duPont at a recent meeting of the Instrument Society of America. If workers of the future don't want to spend seven days in the plant (like the worker dressed in his Sunday-best above), we'll have to perform miracles in improved productivity. He provides this arithmetic to support his position:

- In the next 20 years, the total population is expected to increase by perhaps 40%.
- The population of working age will increase by less than a third.
- The labor force in manufacturing and agriculture, with more people going to college than ever, and more going into service work, is expected to increase by less than 20%.
- If our standard of living continues at its present rate of increase, each of us will require twice the goods and services we use today.

Add 'em all up, and the 1978 employee must produce twice as much for himself and four other persons. He can do it with the help of improved instruments and machines. Or he can make some headway of working a seven-, not a four-day week.

Makes a convincing argument, doesn't it?

Older Workers Find Jobs

Pennsylvania isn't sitting on its haunches waiting for the "older worker" problem to go away. The state Department of Labor and Industry, in co-operation with the U. S. Department of Labor, recently completed a pilot study of the effects of hiring extra "public" employment counselors to specialize in finding jobs for applicants over 40. Some of the results of the study:

1. Finding a job for an older worker takes four times more hours than for an average applicant.
2. But jobs can be found—at least jobs were found for two out of five applicants. And this doesn't count the applicants who went out and found jobs on their own.
3. Most older applicants have good work records. They are unemployed for reasons they cannot control.
4. It's easier to find jobs for older workers in small firms than in large.
5. Many employers who hesitate to hire older workers as a general rule will change their opinion if they meet and get to know the applicant.

You might particularly remember Conclusion 5, above, next time you refuse to consider an older applicant. You don't want your manufacturing floor turned into an old folks' home, but refer to the experience of Philadelphia's employers. Given a chance, some of the older applicants turned out to be just the man they needed.

Young Artist, Happy Papa

Shirley Quail, age 7, drew the angel that was reproduced in four colors on the cover of a recent issue of the *Hercules Mixer*, employee magazine of the Hercules Powder Company (Wilmington, Del.).

Shirley (shown above with proud Papa) is one of the budding artist-and-poet offspring of employees who sent samples of their work to a company contest. And she was just one of 106 winners. The prize for all winners: publication of their work in the magazine. Sixteen pages were devoted to winning children's offerings.

The contest is open to children of employees at any of the company's 31 locations. Age limit is 13 years. A panel of professionals in children's art and writing does the judging. The last contest drew 600 entries.

Hercules has its contest just before Christmas. But there is no need to hold this fine employee relations idea until next December. You could do it for Easter, make it a May art show, hold it any time that's convenient.

Leisurely Idea Man

One step in the creativity process is relaxing. The rest of the process is hard (but enthusiastic) work. Battelle Memorial Institute's Lewis E. Walkup has this to say on the subject of creativity in research:

"Creative individuals are attracted by any problem in almost any field. They can feel enthusiasm for almost any mysterious phenomenon. The creative person differs from the specialized expert, who may sometimes appear to create but is primarily motivated to be 'expert' or an 'authority' in a specific field. The 'authority' will be eager to talk about what he knows about a field. The creative person doesn't care to dwell on what he knows; he is far more interested in thinking and talking about what he does not know."

How does one create? Walkup suggests four steps that, he says, may help to promote the flow of bright ideas.

1. Recognize that the act of creating is primarily an exercise of the intellect. Therefore it's essential for the man who wants to create to use his mind to its full capacity.

2. Build up the idea that nothing is as important to your problem as the mental work you must do to solve it. Put out of your mind all the worries of scheduling, economics, interpersonal relations, even pleasing your superiors.

3. Put yourself in a leisurely mood. No thought that bears on your problem should seem too frivolous to ponder.

4. Get lots of clean paper, a sliderule, perhaps a few reference books, and a handful of sharp pencils. "Then *think, and think, and think.*" Jot down everything that occurs to you.

Here's a final warning from Walkup: Creating is one of the most trying and exacting things a man can have to do. Therefore you may unconsciously try to avoid it. Watch out if you find yourself resharpening the pencils, taking a trip to the water fountain for the third time.

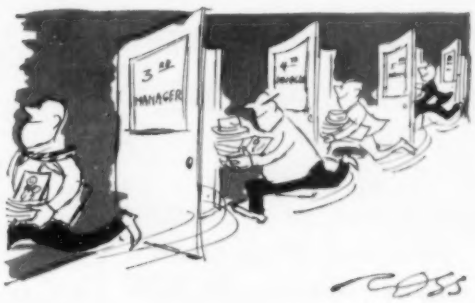
Taking the Offensive

Annoyed at always being on the defensive in union contract negotiations? Looking for items that lend themselves to management contract demands? Here's one that's often overlooked. It's demonstrated by a recent arbitration case of the Warner Electric Brake & Clutch Company (Beloit, Wis.).

During a vacation shutdown the company offered a junior employee work to which a senior man was entitled. The senior man knew all about the situation, but didn't file a grievance until the 30-day time limit was almost up. His plan: Collect 30 days' back pay instead of the two or three days he would otherwise get. The arbitrator in the case exercised good judgment. He saw through the delay, granted just three days' back pay.

Took an arbitrator to solve this obvious problem. It's not an unusual one. As another example of the same kind of device, maybe you've noticed that the union often is in no great rush to speed contested disciplinary discharge cases to arbitration. The motive: to build up the back pay award in the event the employee is reinstated.

What can you do? You can take the offensive in bargaining. You can demand that your next contract carry the provision that unjustified delays will not work to the disadvantage of management.



Fast-Moving Managers

Want to keep your management people moving, like the happy men in the cartoon? Vice President Charles W. L. Foreman, United Parcel Service (New York), proposes a simple plan to do this. He told his plan at a recent meeting of the Society for the Advancement of Management.

Mr. Foreman claims this appraisal-assignment-appraisal plan will solve the selection problem, keep everybody in management moving at his best rate:

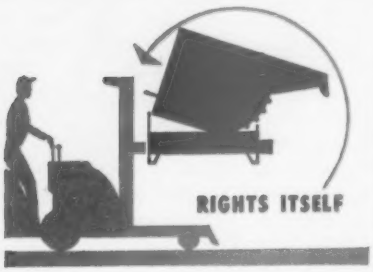
1. Evaluate every supervisor regularly. Decide whether he is doing his job well. If he is, he has obviously proved himself capable of learning it.

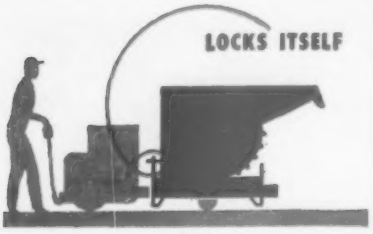
2. If he has learned his present job, give him a new one to broaden him and to test his ability to learn that job.

3. Evaluate him again, and move him as soon as he is doing the new job well.

Sounds a little idealistic. But there's a core of tested good thinking here. Once they've made a man a manager, many successful companies would rather lose him than stop him in a job. He may be very capable in that spot, but his motives change from ambition to protection in short order. Then you get "seniority" management thinking.

Here's a challenge: Try the system in your supervisory force. And see if you have the courage to upset the applecart in the effort to rule out seniority management.





Cuts handling time ...and costs...in half

Here's the fastest, lowest cost method ever devised for handling all kinds of bulk materials . . . hot or cold . . . wet or dry . . . such as:

Punch Press Parts . . . Cinders
Hot Forging or Castings . . . Scrap Metal
Pickles . . . Soybean Meal

A Roura Hopper fits any standard lift truck . . attached or detached in seconds . . can't slip off. One man does the entire job. Picks up loaded Hopper with lift truck . . . transports it to destination . . . flips the latch . . . and the Hopper automatically dumps its load, rights itself, locks itself. Cuts costs 50% or more.

They're sturdily made of heavy 3/16" steel plate with continuous arc-welded joints. Five sizes from ½ to 2 yards capacity. Fitted with live skids or a choice of wheels. Standard models available for immediate shipment from stock. For special applications they can be made of stainless steel or galvanized.

ROURA
Self-Dumping
HOPPER

WANT MORE FACTS?
We'll give you full details . . . without obligation . . . if you'll attach this coupon to your letterhead . . . sign your name . . . and mail to . . .

ROURA IRON WORKS, INC.
1423 Woodland Ave., Detroit 11, Michigan

FACTORY BOOKS

Top Look at Organization Theory

Two prominent social scientists at Carnegie Institute of Technology (one of them also a noted operations researcher) in a new book, *Organizations,* have made a learned examination of the many classical and modern theories of organization. If you're looking for practical solutions to practical problems of organizational structure and staffing, you won't find any direct help in this book. But if you're seeking stimulation and a new and different perspective to help you "think out" your own solutions, this may be just your dish.

Frankly, unless you enjoy an erudite excursion into philosophically deep waters, you'll probably find *Organizations* difficult and even unrewarding reading. But if you do have such a bent, you'll find it utterly fascinating. Not because the authors attempt to evolve any new philosophy or organization as such. But rather because of the uniquely analytical way in which the authors examine the components of the many theories put forward by others. (And there are some barbs in the writing that are truly surprising in a basically "clinical" book. If you find a certain sadistic pleasure in seeing some of the all-time great subtly but devastatingly deflated—and which of us doesn't, at least now and then—well, here's one source that isn't going to disappoint you.)

Organizations, by James G. March and Herbert A. Simon. John Wiley & Sons, 440 Fourth Ave., New York 16. 273 pages. $6.

What's in a Curtain Wall?

Not only what's in 'em, but where to use 'em, where not to use 'em, and practically everything else you might want to know about the seemingly ubiquitous curtain wall.

You'll find it all in *The Contemporary Curtain Wall*—so far as we know the first book ever devoted entirely to this increasingly important subject.

If you're considering a new plant or an addition to your present one, you'll find this book tremendously helpful. (You'll want it also if you're building a new home or are a member of a school board faced with building—and what school board isn't these days?)

The last chapter in the volume is a fascinating look-ahead at both technical developments and the possible architectural consequences of curtain walls. Of course, if your personal taste runs strictly to Victorian gingerbread or granite monoliths, this chapter may give you apoplexy —if you get this far. But for the modernistic reader or for the executive with his eye on saving a buck for his company, it's happy reading indeed.

The Contemporary Curtain Wall: Its Design, Fabrication and Erection, by W. D. Hunt, Jr. F. W. Dodge Corp., 119 West 40th St., New York 18. 462 pages. $12.75.

Cool, Man, Cool!

Here's a book that's right at the top of the "must" list for any air conditioning engineer, or any plant with a cooling problem. (And that includes cooling process water as well as air conditioning.) *Evaluated Weather Data* is the most extensive volume of temperature-humidity-prevailing wind information ever compiled exclusively for people engaged in cooling-design problems.

The price tag ($35) looks big for a small book. But it's peanuts compared to what you can save by proper design or selection and placement of a single, small cooling tower. Superb isothermal maps (wet bulb temperature frequency for 1%, 5%, and 15% design levels), psychrometric charts for 49 cities, and well-designed tables summarize the results of more than 10-million summer

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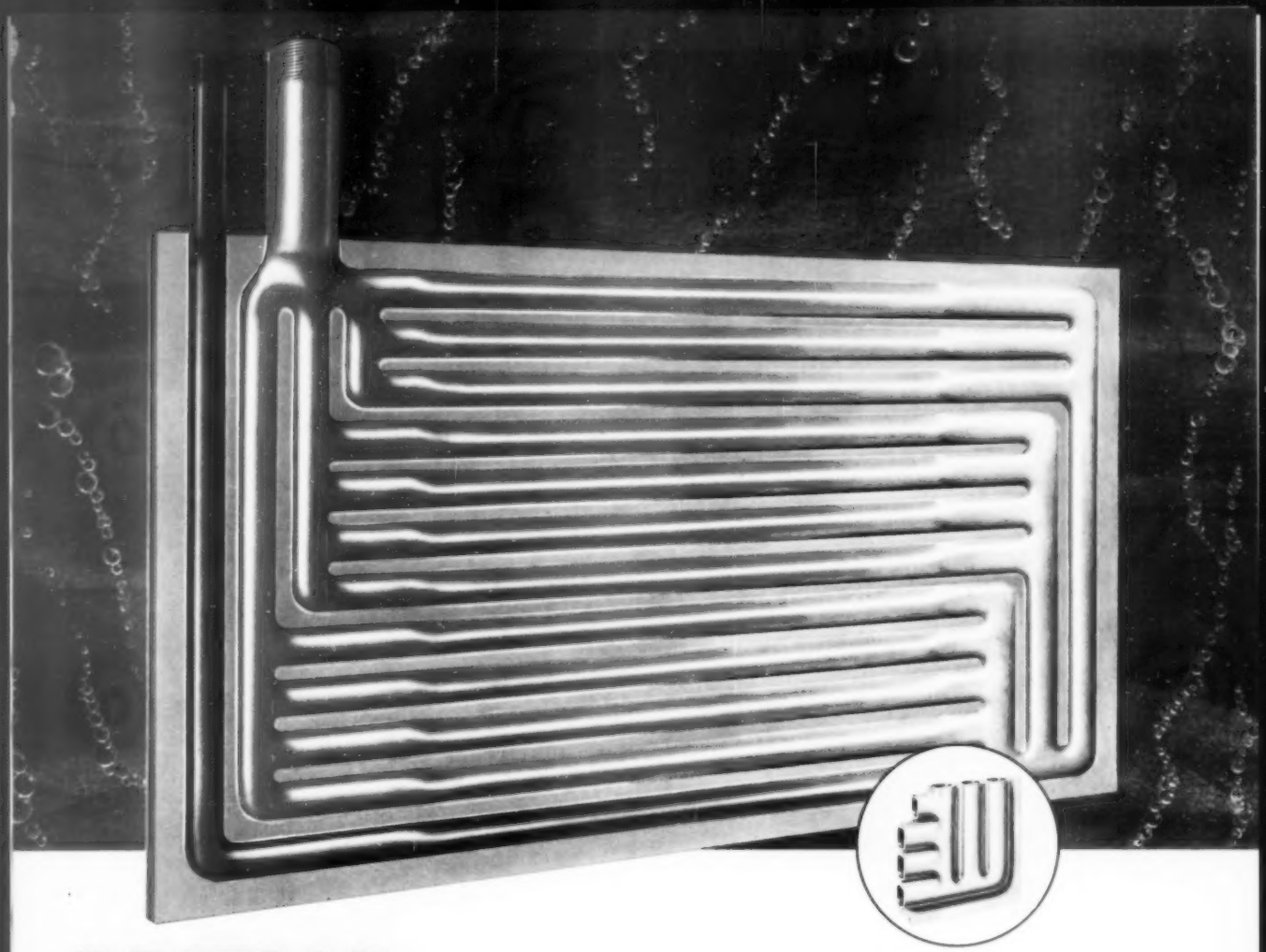

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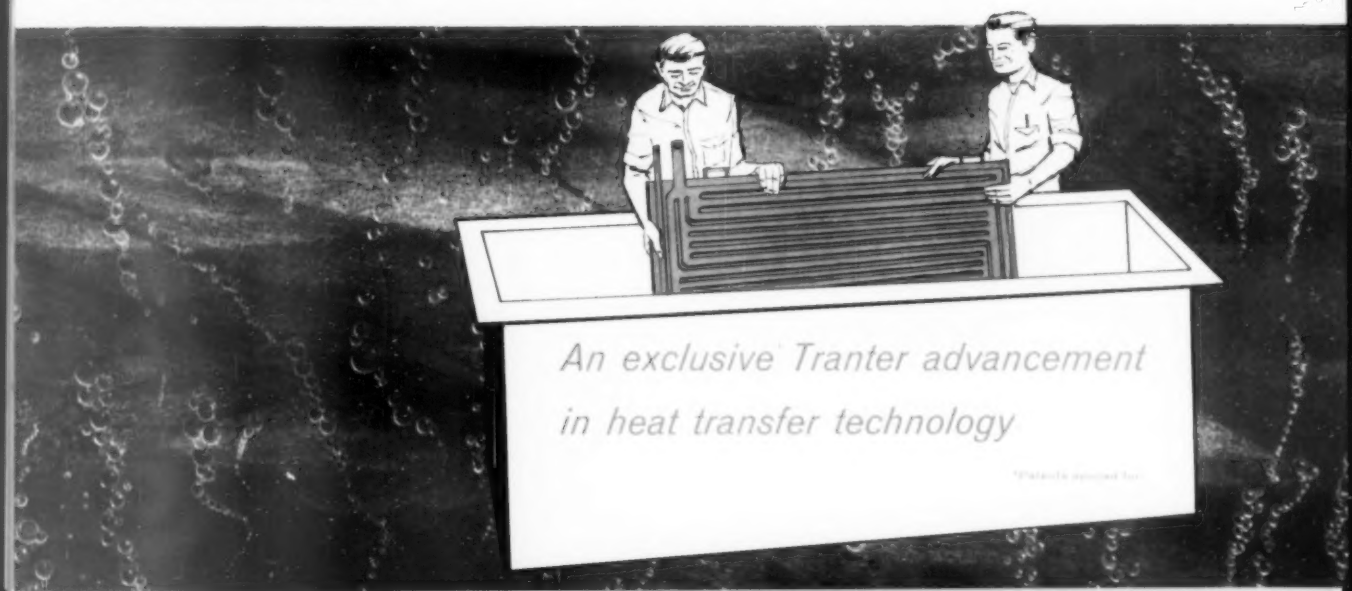

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Evaluated Weather Data for Cooling Equipment Design, privately published by Fluor Products Co., Whittier, Calif. 83 pages. $35.

How Key Men Manage

A series of vignettes of 16 successful managers of many types of companies (and one labor union) makes interesting as well as informative reading. The men chosen to be interviewed on tape for *The Decision Makers* are colorful as individuals. Also each represents a particular attitude or point of view with regard to some important management problem. More often than not, these men are addressing themselves to top management corporate problems. But the better understanding of "how the front office thinks" that you can get from this book will help you both in your career planning and in your relations with your company's top brass.

The Decision Makers—Case Histories of Successful Management, edited by R. R. Conarroe. Vision Inc., New London, Conn. 180 pages. $10.

How Workers Act

A man's work affects the pattern of his complaints. The character of his work group, his dependence on other workers, the prestige his job has in the shop—all influence grievances. The supervisor should not be held responsible for every complaint invented by his frustrated crew. Research backs up this point, made in *Behavior of Industrial Work Groups.* You should read this if you work with employee grievances. But not if puzzles make you violent. It's a hard book to read. It's in the strange tongue scholars use to impress you.

Behavior of Industrial Work Groups, by Leonard R. Sayles. John Wiley & Sons Inc., 440 Fourth Ave., New York 16. 182 pages. $4.75.

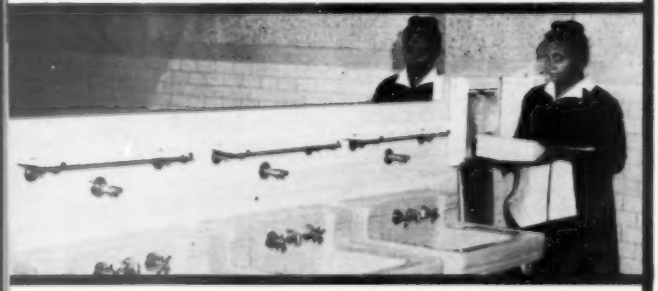
Cocoanut Grove calls on Scott Washroom Advisory Service... free film shows how you, too, can reduce washroom costs

Scott's Washroom Advisory Service is offering free showings of a 14-minute film that gives tips on how to analyze washroom costs. It also shows how to modernize and increase the efficiency of existing facilities with a few simple changes.

Scott's Washroom Advisory Service is based on experience accumulated in close to a million business and industry washrooms. The service is free and entails no obligation. Send the coupon.

Mr. Philip J. Weber, vice president and general manager of the Ambassador Hotel of Los Angeles, called on Scott's Washroom Advisory Service when redecorating the hotel's famous Cocoanut Grove. Scott experts helped modernize the Ambassador's 36 public and employee washrooms.

Scott recommendations included special lighting for make-up in the women's lounge adjoining the Cocoanut Grove.



Notice the soap dispensers over the washbowls—another Scott suggestion that saves soap, improves appearance and reduces maintenance time.

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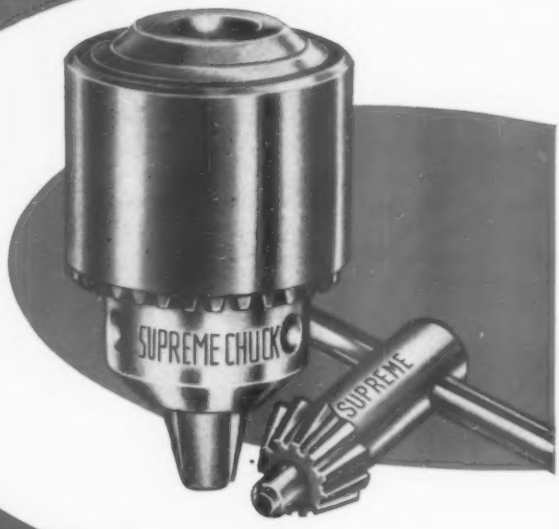

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Quaker Rubber Div., H. K. Porter Co., Inc., Tacony & Comly Sts., Philadelphia 24.

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United World Films, Inc. (Industrial Dept.), 1445 Park Ave., New York 29.

Packing for Lowest Landed Cost depicts a large packing firm boxing products from small precision parts to giant diesel powered equipment for overseas shipment. Shows how motor trucks are disassembled, processed, boxed at the rate of two every nine minutes. 16mm, color, sound, 12 min. For loan, write to:

Hyster Co., 1003 Myers St., Danville, Ill.

The Rival World presents man's ever-present struggle against insects. Has many exciting sequences—one is a head-on airplane flight into a horde of locusts. 16mm, color, 27 min. For loan, write to:

Shell Oil Co., 50 West 50th St., New York 20.

Illustrated Catalog covering the rental of motion picture equipment and accessories is available. Projectors, cameras, etc., are listed. For free copy, write:

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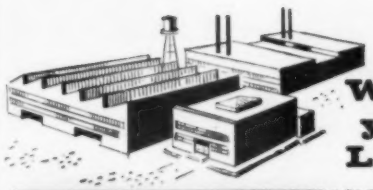

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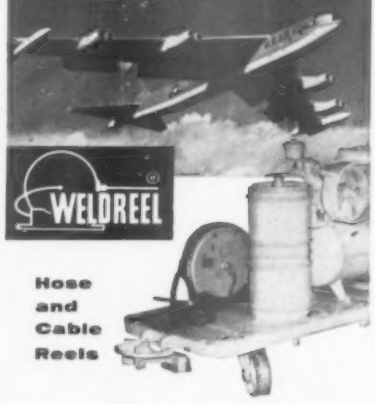
SUPERSONIC PLANES GET FACES WASHED FASTER.....*BETTER*



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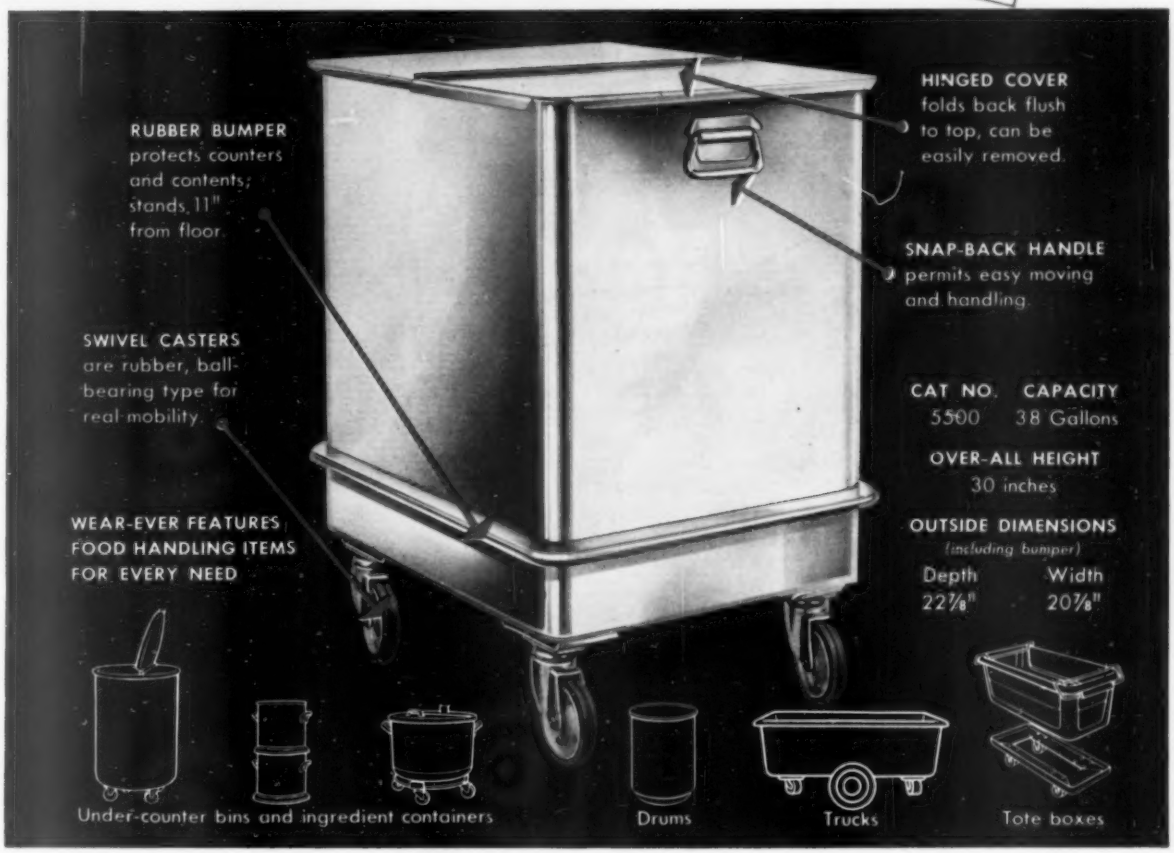
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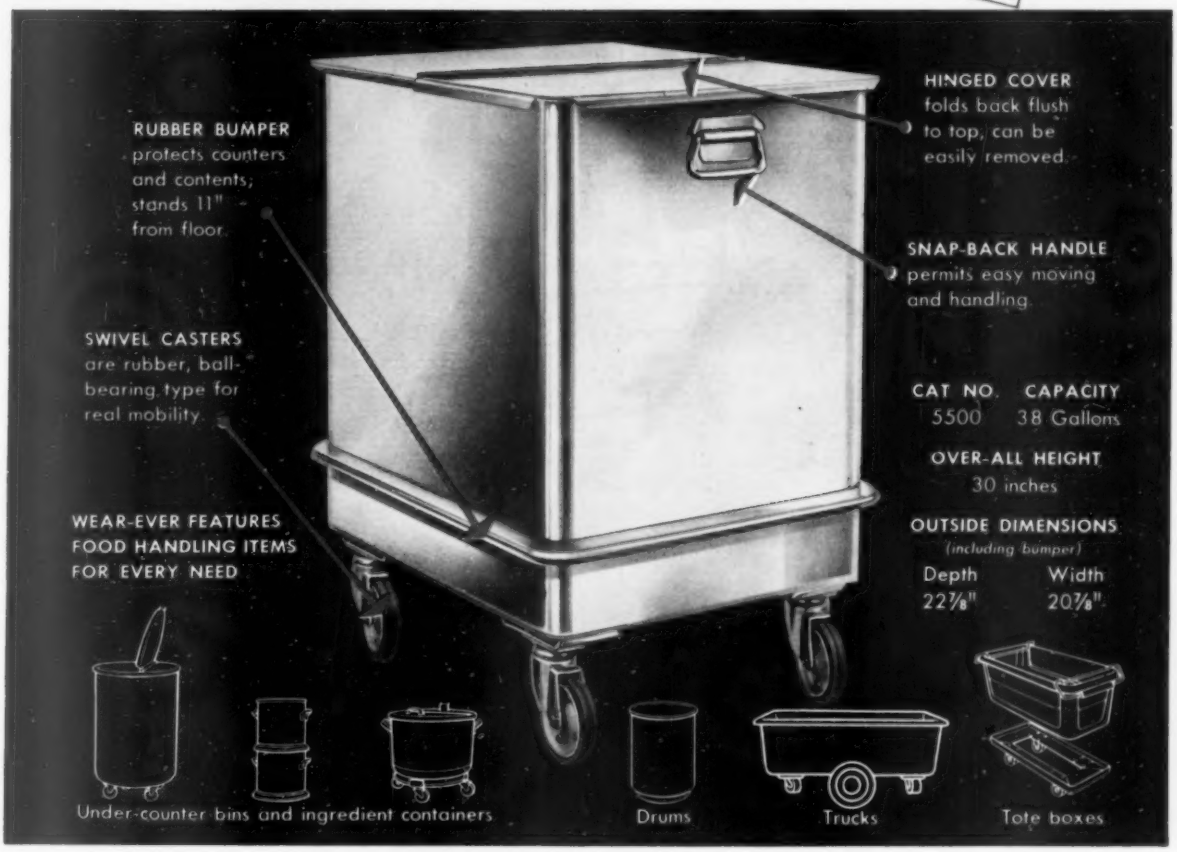
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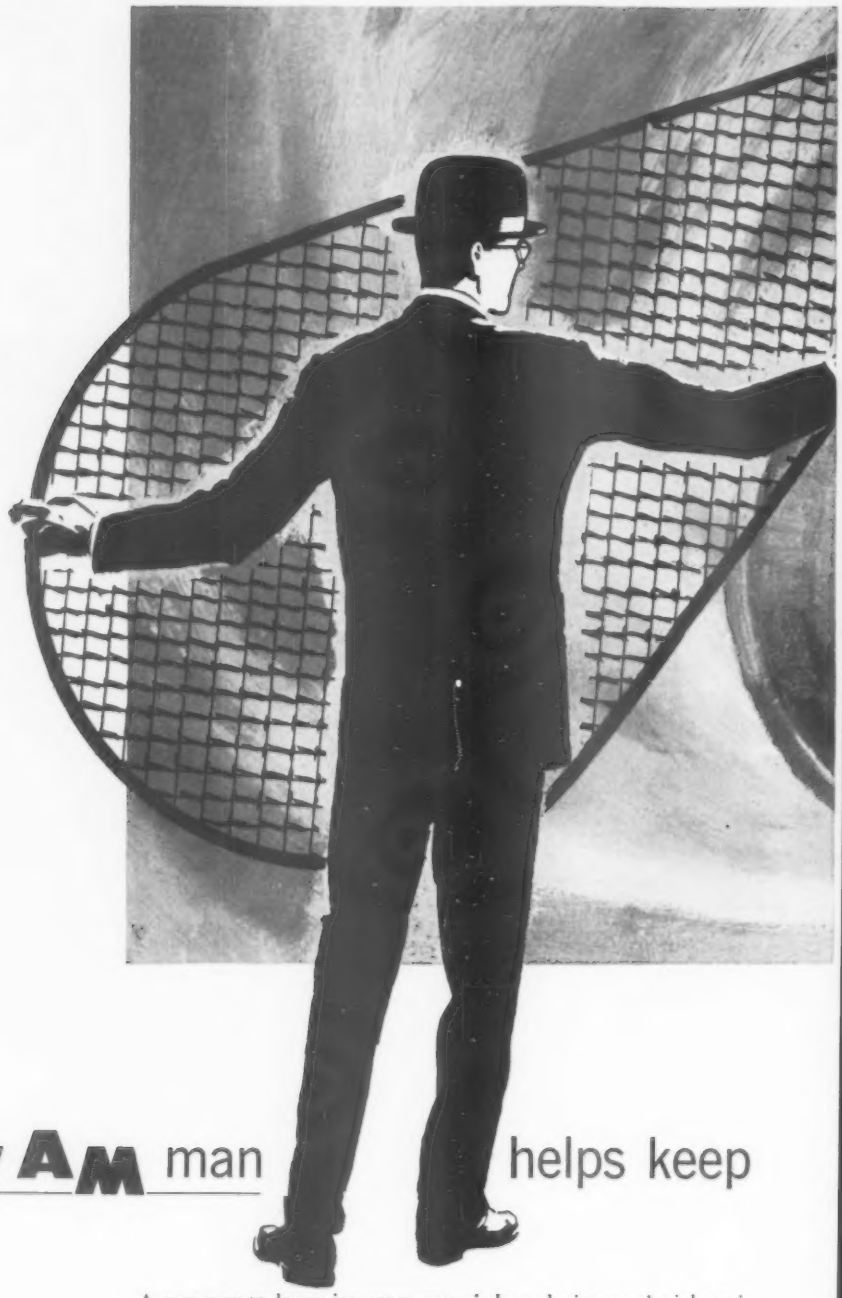

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A sure way to lower insurance costs is by reducing on-the-job accidents. And famous for doing just this are the Safety Engineers of Mr. Friendly's company—American Mutual.

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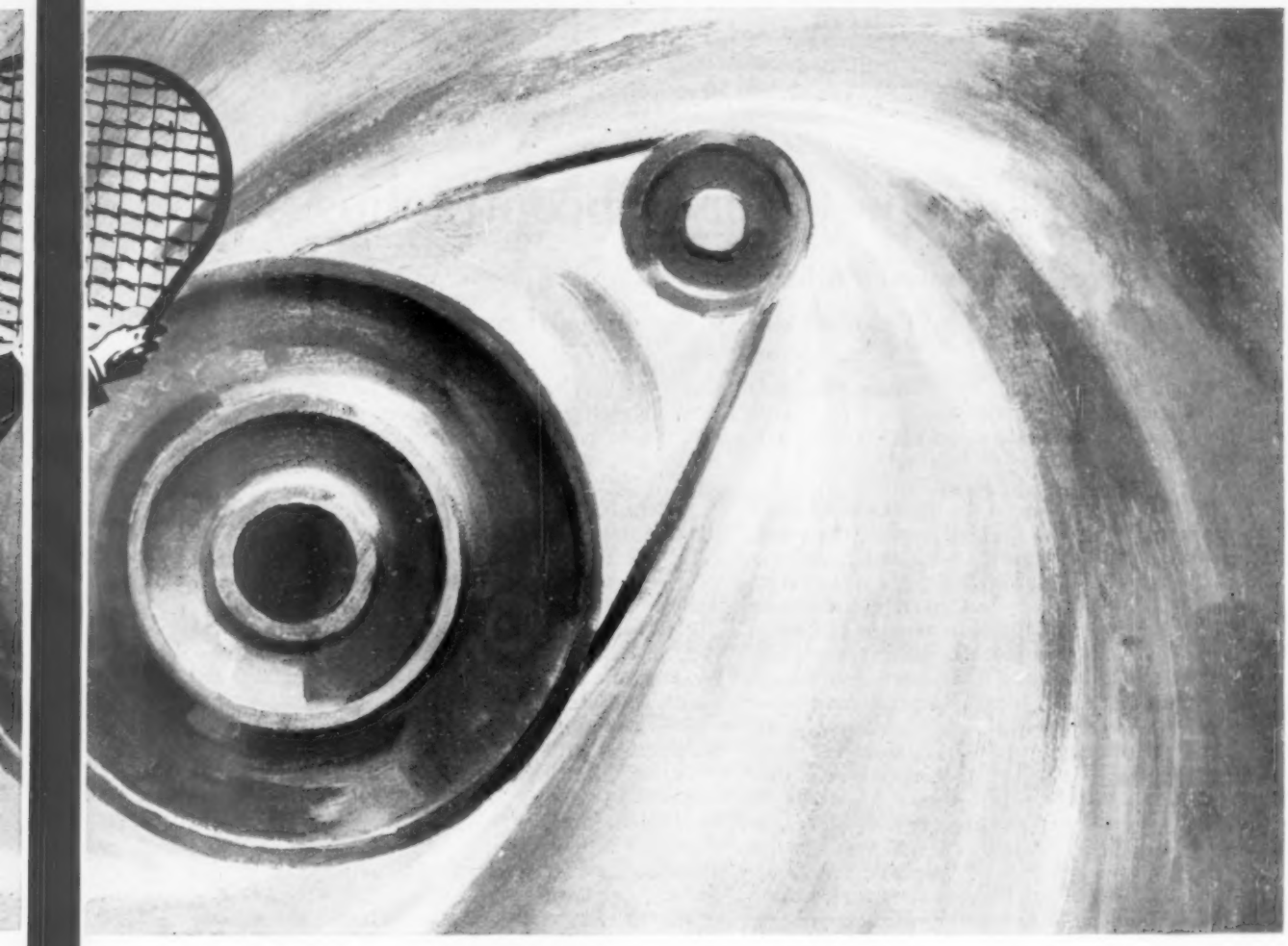

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By PAUL A. KING, Attorney, Bigelow-Sanford Carpet Company, Inc.; Member, New York Bar

Helpful Guideposts for Subcontracting

Considering subcontracting some work out? Here are the points you should consider before you decide to call in the subcontractor.

When the pinch is on for lower costs, management takes a cold look at all its operations to see what can be subcontracted out at attractive prices. Trouble is it may be hamstrung with the wrong contract clause and an opinion from its attorney saying: "You're stuck."

First operations to come in for the callous look are the cafeteria, janitor, and cleaning services, the watchmen and the guards, tool and die work, and the delivery and hauling service. If you approach the union for its blessing, in addition to an icy look you'll get a statement like this pulled from an American Cyanamid arbitration award: "If one was to conclude that the company could, when it chose to do so, lay off its regular employees and call in contractors to take over and perform the work by the contractors' employees, such conclusion would in effect make a nullity of the existing contract." With sights still on the dollar savings, you may call upon your lawyer for a ray of hope. The National Association of Plumbing Contractors knocked on the door of its legal counsel (George P. Lamb) and when Lamb came to the door it was with a discouraging message. Said Lamb, in typical legal style: There are two kinds of subcontracting clauses. One says you can't hire outside contractors when your own employees can do the work. The other says you can't contract out work to contractors whose wages and working conditions aren't up to snuff. Continuing, Lamb went on to say: "Two possible attacks on such clauses are possible. The anti-trust laws and the Taft-Hartley law. Neither are helpful."

Unless you have an out-and-out contract clause nixing subcontracting, you do have some hope. It may be the one time that an arbitrator may come to the aid of the employer. That is, if you get the right arbitrator. A careful look at the decisions will turn up no line of cases clearly saying you can't do it, nor clearly saying you can. But you have a solid chance of getting away with it. Sadly said the arbitrator in the Weber Aircraft Corporation award: "There is no long line of decisions supporting the reasoning of either side . . . no sure and guiding light."

But a year or so later Arbitrator Melvin Lennard bravely set forth guideposts for employers who have to put a subcontracting case into orbit in the arbitrators' celestial realm. Here are the 11 factors he says arbitrators consider:

1. Whether the subcontracted work is to be performed continuously or intermittently.

2. Whether such work is to be performed permanently (or for an indefinite period) or temporarily.

3. Whether an emergency is involved.

4. Whether the skills possessed by members of the bargaining unit and by supervisors and managers are sufficient to perform the particular work proposed to be subcontracted, or whether they are economically available to the company.

5. Whether the necessary equipment is possessed by the company or is economically available to it.

6. Whether the judgment of the company is exercised in good faith or exercised in an effort to discriminate against the union.

7. Whether, aside from the good faith of the company, the effect on the union is substantially harmful, including the effect on size of the bargaining unit and continued existence of the union.

8. Whether there is a substantially harmful effect on the members of the unit in these or other ways.

(a) In substantially reducing the number of jobs available to them or otherwise substantially affecting their job security. (The number of jobs available is important to those already laid off and awaiting reinstatement, and to those presently employed who may be subject to layoff.);

(b) In affecting their wage standards and/or conditions of employment as may occur through working side by side with employees of the subcontractor.

9. Whether the jobs affected by the subcontract are those which in the particular industry are frequently the subject of a subcontract, such as certain maintenance and construction jobs, window washing, guards' jobs, trucking, etc.; also whether the jobs are substantially different from the kind of work which the company normally undertakes to perform.

10. Whether a loss is sustained by the company on the operation which it proposes to subcontract, or whether its profits from it are unreasonably low.

11. Whether the action of the company in subcontracting is otherwise arbitrary or unreasonable.

Mental Sickness

The mentally ill employee, say arbitrators, can't be fired unless he is a potential menace to himself or to others on the job, can't do the job, or his job presence adversely affects efficient production.

But sympathy is with the employee. Arbitrators require a high degree of proof before discharge—or even before putting him on sick leave.

An arbitrator in a recent case involving the Reynolds Metals Company stated that plants are not places for

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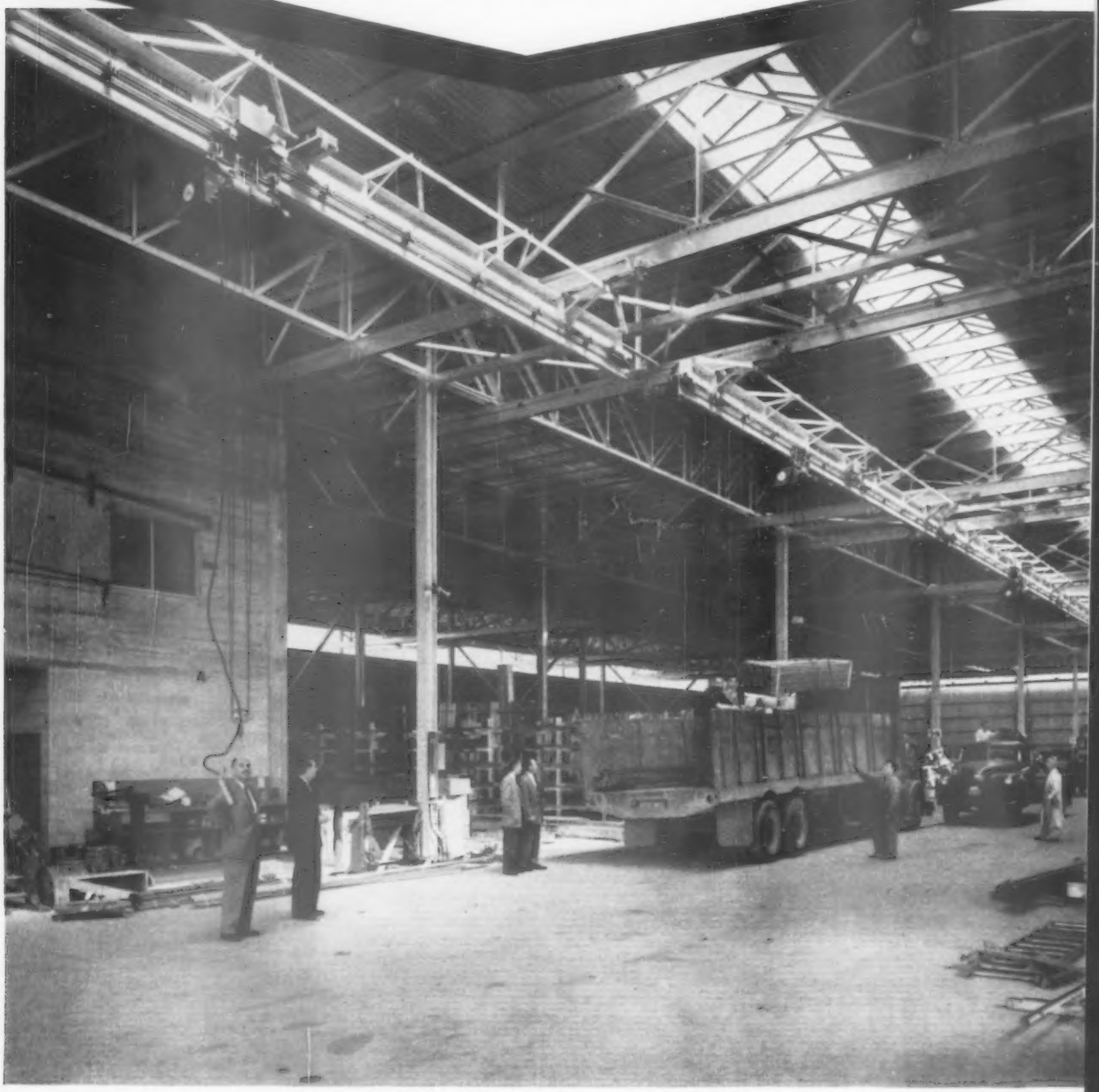

the rehabilitation of sick people. Employers are not contractually bound to assume this burden. But before backing up Reynolds' action in placing a 15-year-service employee on sick leave because he was mentally ill, this arbitrator proclaimed he would hold the company to a measure of proof that is "unusually strong and compelling." Reynolds apparently sustained that burden because its sick-leave ruling was upheld.

The employee was on the payroll since 1942. Never gave any trouble although he frequently argued with fellow workers. But that was because they needled him, kidded him, made him the butt of their jokes. The company put up with him for 15 years. Then when he complained after one of his arguments that other employees were always talking about him, he was placed on sick leave and with the assent of the employer and his union he was examined by two psychiatrists, his own physician, and the company physician. All agreed that the employee suffered from schizophrenia (paranoid type). The only lack of unanimity among the doctors was whether or not he was potentially dangerous to himself and to others. The arbitrator said:

"The grievant conceivably might work safely and efficiently for many more years as he unquestionably has done for 15 years in the past, should I return him to his job in the face of this convincing medical evidence of his illness and disability. On the other hand, he conceivably might not—the psychiatrists and general medical practitioners may be right in their opinions that he is potentially dangerous to himself and others. I cannot take the chance and the agreement does not require the company to take the chance."

The arbitrator noted, however, that discharge was not involved here. The employee had been placed on sick leave and was receiving benefits that a discharged employee wouldn't get. This might have been a determining factor in his decision.

Pre-Election Pep Talks

Back-room meetings may decide political fates, but it's no place for union representation election discussions, ruled the NLRB in the Peoples Drug Case. But come right out in the open as this employer did and you are home free, ruled the Board.

In the Peoples Drug case, store managers and employees met in back rooms and basements where management offered its views on the coming election. Although the speeches made were not in themselves coercive, it was a case of bad environment. This clad the employer with a power and authority he wasn't supposed to have had.

But with Crane Carrier Corporation things were dif-

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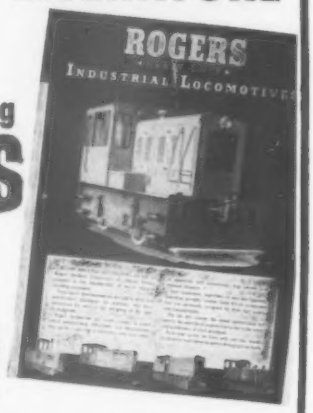

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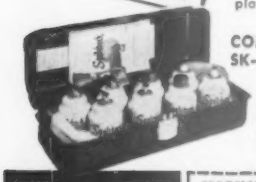

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Begins on page 182

ferent. With true employer enlightenment all along Crane had been holding weekly plant meetings with its 88 employees to discuss production and other problems. Every 60 to 90 days the employees were spiced up with a session personally led by the company's president. More production and employee problems were discussed. Just before the union election, the President had five such meetings but this time he read a list of employee representation rights. Emphasized the employee's freedom of choice and at three sessions explained the company's position. *All meetings were held in a conference room on company property.* Employees had to attend, were paid for attending.

An NLRB regional director, not quite getting the pitch, likened this to the Peoples Drug case. This is different, lectured the NLRB in its upsetting ruling. "The meetings here . . . were part of a series of meetings which were regularly and periodically held in the conference room. Thus, although the meetings were not held in an open plant area, it is clear that the conference room was not a locus of managerial authority in which employees do not normally go."

One Party Arbitration

What happens when the employer refuses to go to arbitration, the union goes anyhow, and the arbitrator hands down an award? Is the award binding on the employer?

No, ruled a U. S. court of appeals. True, the employer should have submitted to arbitration and argued before the arbitration tribunal that the matter was not arbitrable. If overruled he could have taken the award to court. Nevertheless, he is not bound by the one party award. The union contract doesn't contemplate one-party arbitration.

Ohio's SUB Battle

The United Steelworkers' SUB (supplementary unemployment benefits) and Ohio's unemployment law clash, but the law prevails—for a while at least.

With anxious eyes on $25,000,000 in SUB money held in escrow, the United Steelworkers took Ohio's unemployment compensation to court in a try to upset its ruling that SUB payments must be deducted from state idle benefits. Winning in two lower courts, the Steelworkers lost in the state's highest court. Next move, get the legislature to pass a law allowing integration of benefits.

Union Shops Held Invalid

A Georgia court finds a way to effectively clip the political wings of unions—at least until the U. S. Supreme Court takes a look at the case.

It started when the court, taking a lesson from a recent U. S. Supreme Court case, refused to rule that union shop contracts under the Railway Labor Act were

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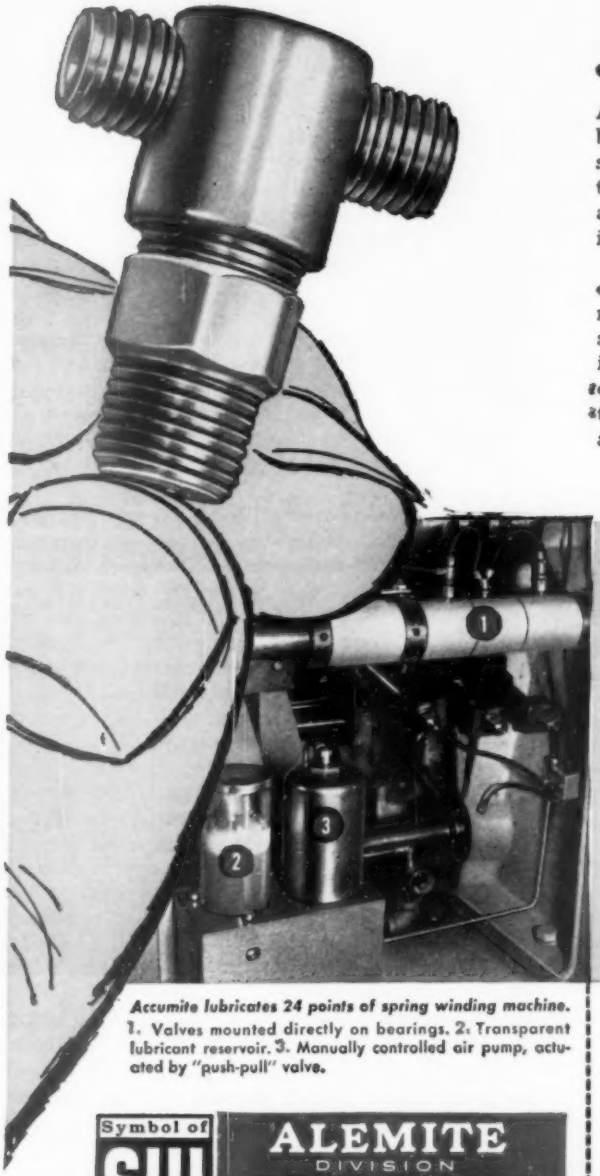

Accumite lubricates 24 points of spring winding machine. 1. Valves mounted directly on bearings. 2. Transparent lubricant reservoir. 3. Manually controlled air pump, actuated by "push-pull" valve.

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Alemite's new compact Accumite system is especially adaptable to light, precision, multiple-bearing machines that have limited installation space. Its small size and simple installation overcomes cost limitations in most plants. Typical applications are: packaging, canning, labeling and textile machines...and machine tools. It is also suitable for tractor trailers, lift trucks and farm implements.

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ALL THE ADVANTAGES OF "BUILT-IN" MEASURED LUBRICATION—PLUS COMPACT SIZE!

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Begins on page 182

not enforceable. The Supreme Court sermon preached that the union shop authorized by the Railway Labor Act is constitutional, takes precedence over state right-to-work laws. But taking a second look at the high court's pronouncement, it noted that the court refused to pass on union-shop validity if dues and union fees are used to enforce "ideological conformity."

Plunging headlong into the loophole it had found, the Georgia court discovered that the union spent dues money to support political candidates and promote laws opposed by non-union employees. This made the contracts illegal—and unenforceable.

* * *

Reporting pay. Where weather conditions forced a suspension of operations, reporting pay was not called for in the contract. And an arbitrator ruled that no reporting pay was due to those employees wishing to work when the majority had walked out because the day's heat interrupted operations. A case of weather conditions, he stated.

Pleading a business loss? If you counter a wage increase demand with a plea that you're operating at a loss and may have to go out of business if you yielded, you may have to show your books to support your story. An NLRB trial examiner ordered the Tennessee Coal and Iron Division of U. S. Steel to do just that.

When to lock out employees. The NLRB just reaffirmed its rule that during contract negotiations, the employer cannot lock out his employees or threaten a lockout. But there is an exception where the employer has reasonable belief that a strike is in the offing and the suddenly called strike will adversely affect plant safety or result in great damage to plant assets. A union's offer to agree not to strike and to extend the contract 90 days was adequate assurance for an employer's shutdown to be considered unreasonable and unlawful.

More union benefits. The Oil, Chemical and Atomic Workers International is not happy with its lot. President Knight called for higher dues. With more money, Knight would hire 16 more international representatives and 16 more organizers, increase strike benefits, put pension and time and motion specialists on the union's payroll and broaden its research, legal, and education activities.

Executive expense accounts. You'll find a helpful article on handling executive expense accounts in a recent issue of the *Yale Law Journal.* Both tax and budget control angles are covered. For a copy send 50¢ to *Yale Law Journal,* 401A Yale Station, New Haven, Conn.

Harassing tactics OK. Some time ago in the Personal Products case the NLRB ruled that slowdowns and similar harassing tactics during contract negotiations amounted to a failure of the union to bargain in good faith. Not so, overruled the U. S. Court of Appeals for the District of Columbia.

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Photo courtesy of Cities Service Oil Company (Delaware)

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The *Clarklift* fork trucks pictured above are demonstrating a new *dual* function. They stack 30% higher than equipment of similar, retracted mast height . . . can *also* drive through low boxcar doors and other tight clearances. Actually, it means you're getting two machines in one.

Utilizing Clark's new *Triple* Stage Upright, you are able to take better advantage of the *full* height of your warehouse . . . yet, use the *same* fork truck for loading rail cars or highway trucks, low-door elevators, etc. The Triple Stage Upright enables your equipment to *work full time*, and on many *varied jobs* with no stacking height loss, no clearance problems, *no work stoppages*.

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SAFE USE OF SLINGS AND HOIST LINES

Lifting Strains Take High Toll of Injuries

Did you know that in some states one in every six compensation claims involves back injuries? And that one insurance company says back injuries constitute 60% of their claim expense?

Hernia is another hazard of materials handling. One manufacturer reported 75% of his compensation claims involved hernias. This high incidence of hernias and back injuries can be greatly reduced by proper lifting equipment and methods.

What can you do to reduce materials handling accidents? Here are some of the answers:

1. **Teach** your workers rated load factors. Warn them not to overload slings.

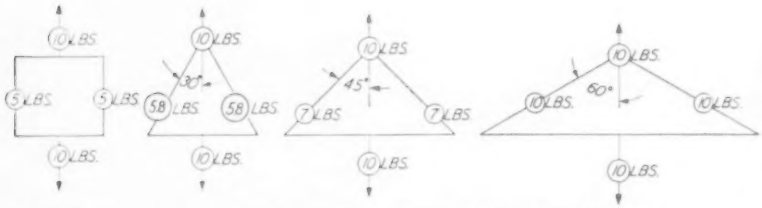
2. **Use** the right size hoist for every heavy lifting job. Don't put the load on human muscle.

3. **Show** workers how to rig hoists properly and safely. Load chains shouldn't be used as slings. Previous distortion and weakening of links may cause them to break even with a light load.

4. **Inspect** hoist load brakes often. Slipping or dragging brakes should never be used.

5. **Be sure** to use the proper sling for the job. Don't assume that all slings made of wire rope are right for all lifting operations.

How Sling-Leg Load Increases with Increased Fleet Angle



These four drawings show approximate load increases on each leg of a bridle sling as the vertical angle of spread between legs increases. For accurate factors for the various angles, refer to your Tuffy Sling Handbook. (Don't have one? Write Union Wire Rope Corporation. Specialists in high carbon wire, wire rope, braided wire fabric and stress relieved wire and strand. 2234 Manchester Avenue, Kansas City 26, Missouri.)

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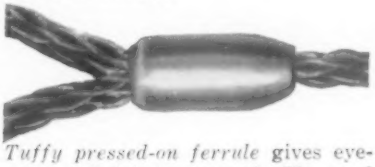
Tuffy Slings have a combination of extra strength and super flexibility. The patented machine-braided fabric is the secret. It gives Tuffy greater strength, faster handling, longer life, greater safety than ordinary slings—at a cost to service life ratio that figures low. And it's so flexible that kinks can be pounded out without material damage.



Tuffy pressed-on ferrule gives eye-splice full fabric strength. The steel ferrule is applied under tremendous pressure. It literally flows into spaces between wires and strands. The friction force thus created gives the eye-splice 100% of the fabric strength. And the streamlined Tuffy ferrule leaves no openings or rough projections to snag or injure hands.

Tie a knot in a Tuffy Sling? Pull it as tight as you can. Even if you kink it, it's still easy to straighten out with no material damage to the sling.

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He's stocked for fast delivery of all your Tuffy Slings and Union Wire Rope needs.

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Gives full data on Tuffy Slings. Types, dimensions, weights and rated loads. Also contains an expanded section on fittings — many not previously shown. Write for your copy now.

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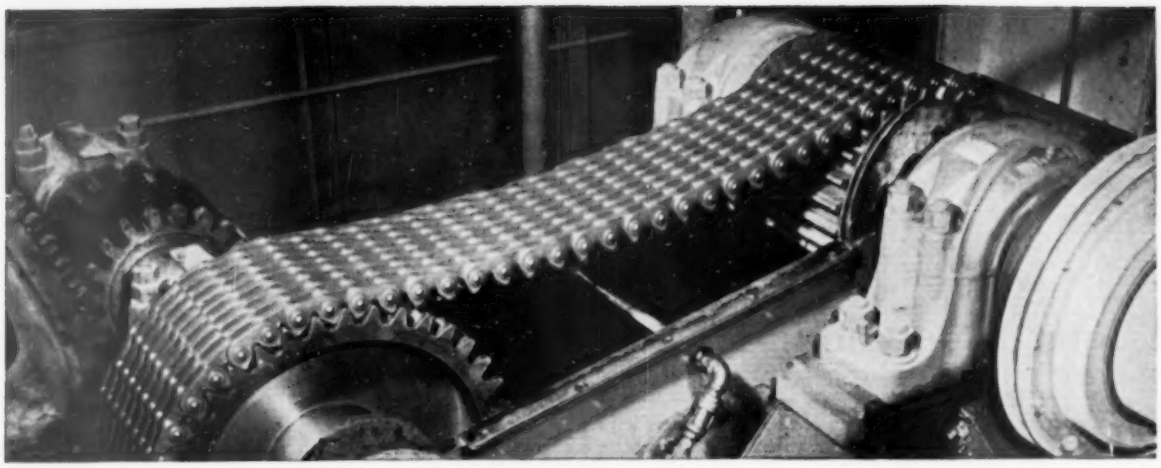

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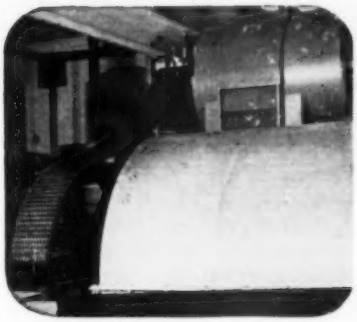
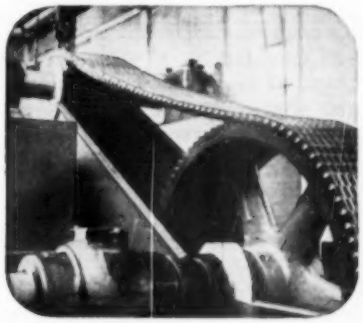
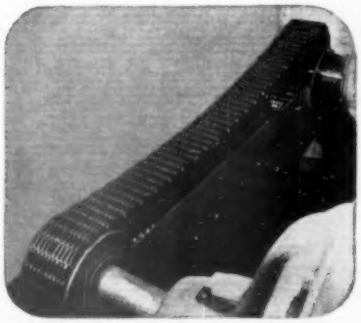


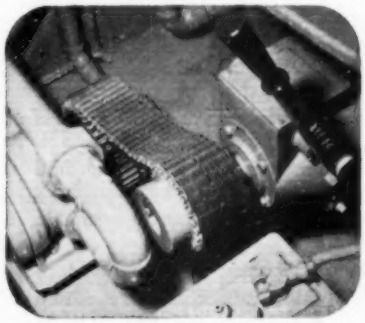
LARGE OR SMALL HP. On a 300 hp drive like this or at fractional hp, silent chain is always lower in ultimate cost.



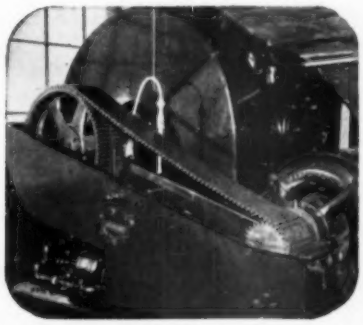
LARGE RATIOS. Link-Belt silent chain operates efficiently on extremely short centers at ratios as high as 10-to-1.



ADVERSE OPERATING CONDITIONS. Heat, humidity and cold have little effect on Link-Belt silent chain drive performance.



LIMITED SPACE. Easy to assemble in close quarters, Link-Belt silent chain permits built-in drives, compact housings.



LONG LIFE. This drive is 16 years old and still going strong. Not unusual—many others have lasted twice that long.

A long time coming, but . . .

Now Those Unmeasurable Jobs Are

Here's an easy-to-use procedure that will measure work on your non-repetitive jobs. Its five easy steps will make measurement 99% right.

COULDN'T BE DONE, they said. "No way to set standards for that kind of work. Too much variety from one item to the next. We'd need a standards applicator for every worker, and that isn't economical."

That is the Number One argument against total work measurement. It's used in small job shops that have no work measurement. It's the prime reason why plants that have work measurement also have a high percentage of work that isn't covered by standards. Sometimes it's direct production work. Often it's indirect work—order picking, maintenance, materials handling, clerical, and so on. The common denominator is a high degree of variety in the work. The cost of time study and developing standard data, and, particularly, the cost of applying standards appear higher than the savings that might result.

The George Elliott Company, Inc. (New York), however, has shown it can be done. Elliott's answer: Multiple Factor Standards (MFS). MFS is especially set up for this kind of work. Elliott consultants began using the technique several years ago. "Correctly applied," says President John D. Dale, "this technique hasn't failed—not once." Here Virgil Rotroff, executive vice president, spells out the details of the Multiple Factor Standards technique.

What MFS won't do—First, Rotroff explains, MFS should be used mainly where the application of conventional standard data would be too costly. It is not the best tool to use where repetitive production is easy to measure with regular methods. MFS will not pinpoint small elemental time differences between products or jobs.

What it will do—MFS will give you standards for non-repetitive work that are as accurate as time study measurement—at a fraction of the time and cost. You can use MFS to extend work measurement to 100% at moderate cost—and with all the benefits that implies.

FIVE SIMPLE STEPS

Measuring work the MFS way takes only five simple steps. Here's how these steps would work in a typical order-picking operation:

1. Select the variable factors—Those that affect the time required to do the work. They're the factors that determine whether one specific assignment will take more or less time than the average for the work. For example, it takes a tool crib attendant longer to fill an order for several items than an order for one or two items. The number of items per order is a variable factor as well as the number of orders. In painting, the number of windows in a wall will affect the time required to paint the wall.

In the example (facing page, top) the variables are orders, packages, pieces, and weight (pounds). Below it are listed typical variables used in MFS applications.

Knowledge of the process, observation of the work, and a study of production records will help decide on the variables. Don't worry too much about having exactly the right list of variables to start. When you get to Step 2 (below) you can add or subtract variables to get the best answer. But you must have a pretty good tentative list to start.

First off, the variables you select must be those that can be recorded economically. It wouldn't make sense to choose a variable that would take several extra people to count, just for application of work measurement. That's what you're trying to avoid in using MFS.

How many variables? The right answer is simply the number that significantly affect the time required to do the work. Practically, you compromise. Of those that are readily measured (preceding paragraph) you select the least number that will provide adequate accuracy of measurement. Elliott's engineers have found that most cases can be handled with no more than four variables. Step 3 discusses this question further from the viewpoint of calculating standards.

2. Provide basic information about the process. You should know how much time (standard minutes) is required for the work. And you need the production count of the variable factors for the workers and time period for which you have standard minutes. Time and production must be directly related.

Measurable

You need several samples of data. The least number of samples is the number of variable factors—a requirement of the calculation step. To provide adequate reliability, however, Elliott engineers recommend 20 to 30 data samples. At this stage it's better to get too many data rather than too few.

A data sample is the data for one random period of time—an hour or two, a day, or even longer. The time length of each sample should be long enough to get a representative sample of the work. In total, the samples should fairly represent the ranges of differences in the variables. For example, if weight per piece is a variable factor, data samples should cover the normal range from low to high weight per piece. Generally, reliability of standards is improved with longer samples—and more of them. But a day's data and 25 to 30 days is about the maximum needed. Naturally the data must be accurate. The standard minutes of work should reflect the actual performance of the workers. In other words, actual time should be adjusted by a performance rating or leveling.

You can use time study or work sampling (ratio delay) to develop the time data. Time study may be more accurate but work sampling is easier—and generally accurate enough. (For an explanation of how to make work sampling studies, see FACTORY, July 1952, pp. 84-89.)

The figures on this page (top right) show the basic information for the order-picking example. They have been abbreviated to include only five samples of data.

Turn the page

How More Variables Make Standards Surer

DATA COLLECTED	Mon.	Tues.	Wed.	Thurs.	Fri.	Totals
	TOTAL STANDARD MINUTES					
Time study time — standard minutes	441	465	473	474	416	2269
No. Packages	6	28	4	12	20	70
No. Pieces	120	40	90	55	20	325
No. Pounds	45	70	10	100	130	355
No. Orders	7	2	16	10	4	39
SINGLE FACTOR						
58.2 Minutes Per Order	407	116	931	582	233	
Percent Error	8%	75%	97%	23%	44%	
MULTIPLE FACTORS						
Using 2 factors						
35.36 Minutes Per Order	247.5	70.7	565.8	353.4	141.4	
14.07 Minutes Per Package	84.4	394.0	56.3	168.8	281.4	
Total Standard Minutes	332	465	622	522	423	
Percent Error	25%	0%	32%	10%	2%	
Using 3 factors						
24.90 Minutes Per Order	174.3	49.8	398.4	249.0	99.6	
12.99 Minutes Per Package	77.9	363.7	52.4	155.9	259.8	
14.12 Minutes Per Piece	169.4	56.5	127.1	77.7	28.2	
Total Standard Minutes	422	470	578	483	388	
Percent Error	4%	1%	22%	2%	7%	
Using 4 factors						
15.60 Minutes Per Order	109.2	31.2	249.6	156.0	62.4	
10.54 Minutes Per Package	63.2	295.1	42.2	126.5	210.8	
1.92 Minutes Per Piece	230.4	76.8	172.8	105.6	38.4	
0.84 Minutes Per Pound	37.8	58.8	8.4	84.0	109.2	
Total Standard Minutes	441	462	473	472	421	
Percent Error	0%	0.6%	0%	0.4%	1.0%	

Checklist of Common Variable Factors

GROUP 1		
Board-Feet	Feet	Pounds
Boxes	Gallons	Square-Feet
Components	Loads	Territory
Cubage	Mileage	Trucks
Crates	Packages	Units
Cartons	Pieces	Yards
GROUP 2		
Batches	Fixtures	Man-Hours
BTU's	Gages	Operations
Changes	Horsepower	Orders
Colors	Kilowatt-Horsepower	Runs
Cycles	Lots	Set-ups
Employees	Machine-Hours	Tools
GROUP 3		
Customers	Letters	Receipts
Deliveries	Lines	Repairs
Installations	Mailings	Reports
Invoices	Materials	Requisitions
Issues	Pages	Sales
Items	Postage	Trips
GROUP 4		
Acreage	Land	Services
Buildings	Machines	Supplies
Docks	Maintenance	Turnover
Equipment	Parking	Walls
Finished Stock	Raw Materials	Windows
Floors	Roads	Work in Progress

GROUP 5

Combinations of the above, such as the value of machinery times hours of operation, rate of material usage, and lineal foot-pounds (for example) may be used to reduce the number of factors.

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One slip can cost more than USS Multigrip"

Men who work in slippery places . . . push heavy loads . . . or merely walk up and down stairs know what it means to have sure traction underfoot.

They can't wear shoes with cleats, but you can give them a floor with cleats—USS* Multigrip. Dozens of little studs provide maximum skid resistance in any direction. They are flat on top, easy to walk on—but do not catch the shoe.

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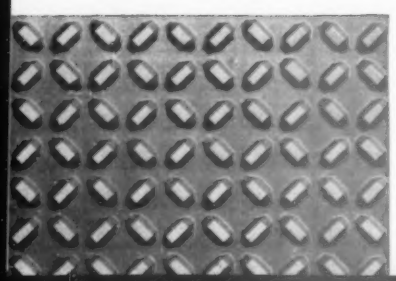
On your next inspection trip, look around for danger spots—and make them safe with Multigrip*. You can get it from our local distributor.

Sold by leading distributors from coast to coast.



United States Steel Corporation – Pittsburgh
Tennessee Coal & Iron – Fairfield, Alabama
Columbia-Geneva Steel – San Francisco
United States Steel Supply – Steel Service Centers
United States Steel Export Company

USS United States Steel

*TRADEMARK

3. Calculate a time formula for the work. If one variable is enough, this is simple. You divide standard minutes by the production count for the variable to get a standard. See "Single-Factor" standard in the computation (page 193).

Chances are, however, one standard will be too inaccurate. In the example application a single standard (58.2 minutes per order) produces errors in performance measurement ranging from 8 to 97%. If you choose to measure with two variable factors, calculation is still simple. It's a problem involving one independent variable (time) and two dependent variables. The problem is solved by the familiar graphical method.

Two variable factors may not be enough. In the order-picking example two standards still leave errors in performance measurement ranging up to 32%. You reduce the error by measuring the effect of additional variable factors. In the example, measurement of four factors brings the error down to a maximum of 1%.

There's a practical limit, of course, to improving accuracy by adding measurement of variables. Elliott engineers have checked the accuracy with alternative numbers of standards in some instances. Where there are several variables they have found that the errors average out this way:

37% for 1 variable factor.
22% for 2 variable factors.
13% for 3 variable factors.
8% for 4 variable factors.
6% for 5 variable factors.
5% for 6 to 10 variable factors.

In the experience of Elliott's engineers, most cases can be handled with only four variable factors.

If an application does require measurement of more than four variables, it's usually better to break the process into two applications. For example, you could separate packaging from order picking. Then you would have two performance measurement applications instead of one covering both operations. There are two reasons for doing this: You probably will improve the accuracy and usefulness of the measurement. And, the amount of work in the mathe-

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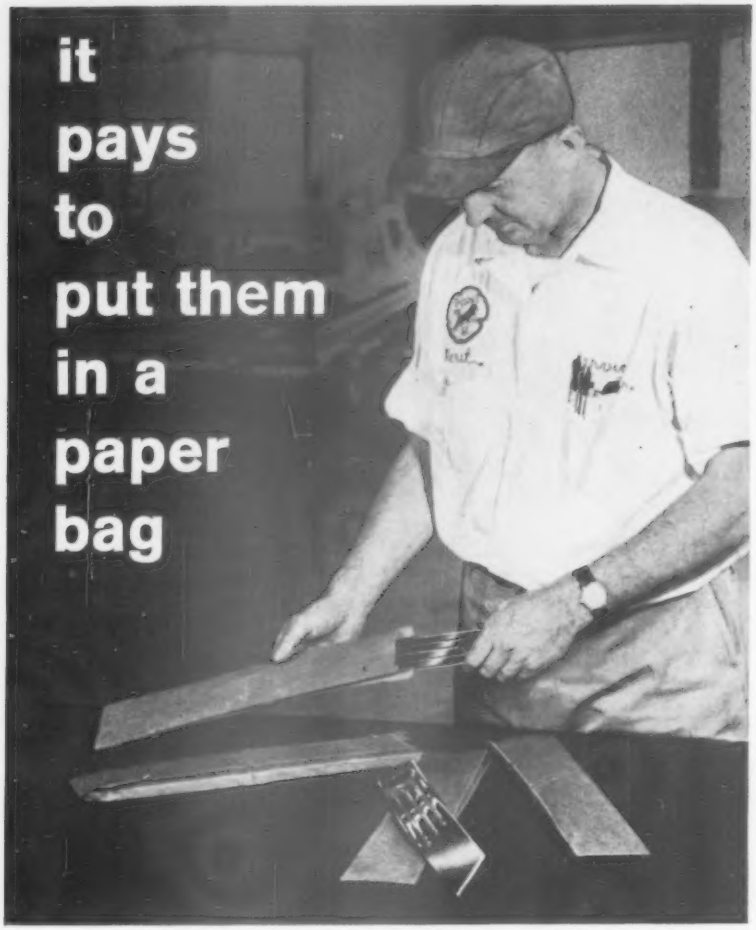

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MEASURING JOB-SHOP WORK
Begins on page 192

matical solution just about doubles with each additional variable.

Calculating the time formula for more than two variables requires something more than eighth-grade math. You are trying to solve a problem that looks like this:

Standard minutes equals . . .

Constant time value A times number of packages, plus . . .

Constant time value B times number of pieces, plus . . .

Constant time value D times number of orders.

Multiple correlation is the technique used to solve for the time values A, B, C, and D. Almost anyone in your plant that has had statistical math in college (preferably not too long ago) can work out the calculation for you. (For brushing up, FACTORY editors recommend "Statistical Procedures and Their Mathematical Bases," Charles C. Peters and Walter R. Van Voorhis, McGraw-Hill Book Company, Inc., New York. Or you can call in outside help.)

The tabulation (page 193) shows the answers for the example order-picking operation. (For a copy of the worksheet showing these calculations, write: Editor, FACTORY, 330 W. 42nd St., New York 36.)

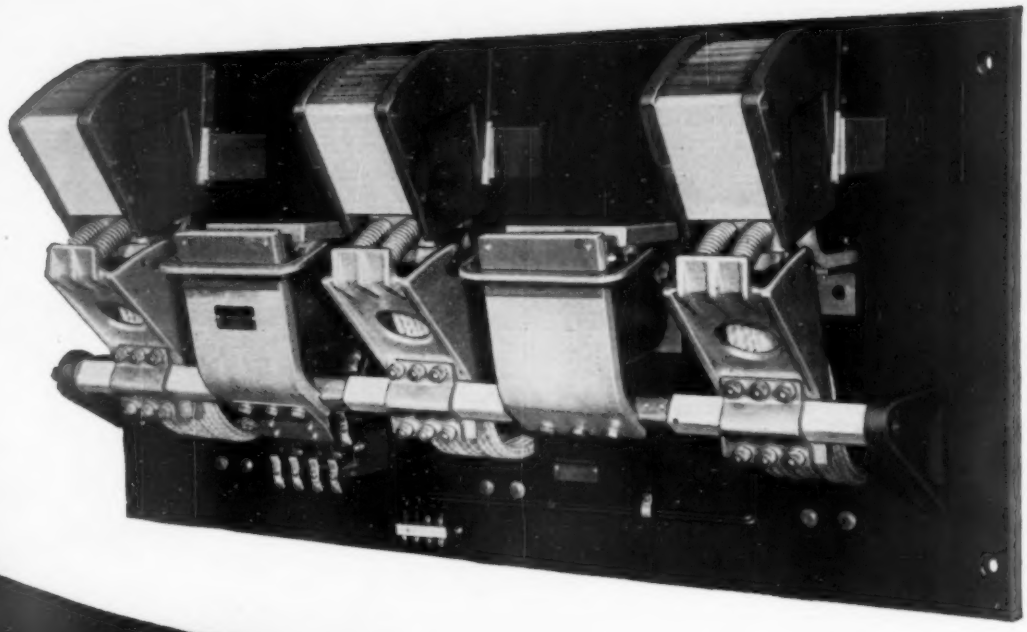
4. Test the formula by applying it to the sample data. About 25 data samples should be enough. If you want to, you can apply the standards to a current test period just to reassure yourself.

5. Install the plan. Success of any work measurement or incentive application rides with how well the plan is introduced to supervisors and workers. Installing an MFS plan is like installing any other similar plan.

MFS can be applied on an individual or group basis. Performance can be measured daily, weekly, even bi-weekly. The period should correspond with that for which a count of variable factors can be reported accurately.

Rotroff adds a word of caution here: For each application write complete descriptions of methods and conditions of the work for which the standards apply. This is important in an MFS application because there are less detailed time study records of the work. **END**

For more facts Circle 569 on Reader Service Card
For more facts Circle 570 on Reader Service Card ➤



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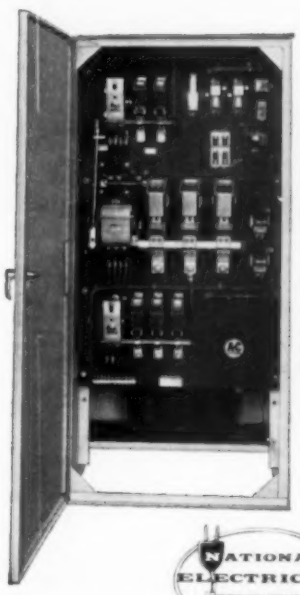

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*7th meaning, Webster's New Collegiate Dictionary, Second Edition.

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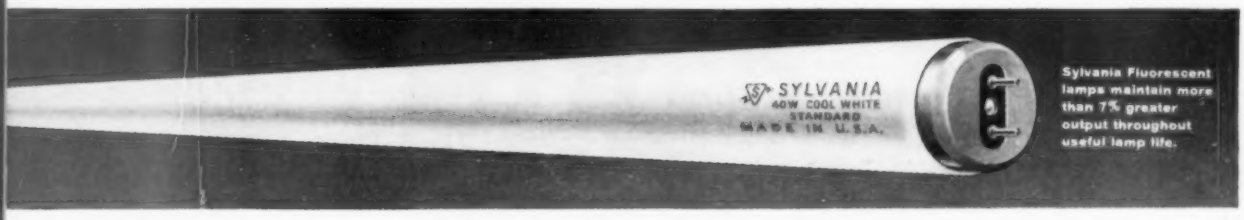
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CATALOG NEWS

For more about these items, circle numbers on Reader Service Card next to back cover.

PRODUCTION

1—Web Processing Machinery. This 4-color 128-page catalog (No. 10) is titled "Web Processing Engineering." It outlines scope of company's service in connection with projects that involve coating, laminating, embossing. *John Waldron Corp.*

2—Turret Lathes. Catalog No. 1179-A (24 pages) presents new automatic lathe. Explains how it pre-selects speeds, feeds, and machine functions electrically. Photos show machines, accessories, and applications. *Gisholt Machine Co.*

3—Pneumatic Production Tools. Small, powerful, high-speed tools are described in 12 data sheets (spiral-bound). Said to be valuable time-savers in tool and die, machine, and pattern shops. Includes photos. *Thomas C. Wilson, Inc.*

4—Spray Decorating Equipment. Here's a 24-pager that covers equipment needed for economically producing mass color decoration. Explains basic mask classifications; lists fixtures and handling devices. *Conforming Matrix Corp.*

5—Surface Grinding Machines. Catalog No. 510 (12 pages) describes new low-cost precision grinders, accessories. Another catalog (4 pages) tells about grinders for small and medium-sized work. Photos. *Brown & Sharpe Mfg. Co.*

6—Horizontal Grate Cooler. This 4-page bulletin (CO-6) discusses various advantages of new unit for cooling materials discharged from rotary kilns, sintering machines, roasters, and furnaces. Includes drawing of design and operation; photographs. *Fuller Co.*

7—Hole Gage, Setting Fixture. Catalog SSC-B1 (6 pages) discusses operation and application of these units. Gives examples of how setting fixtures can be used to set gage to dimensions of ½ tenths. Other data. *Sunnen Service Corp.*

8—Batching Systems. Latest developments in the field of batching control are presented in 8-page bulletin (Form 2964). Shows large panels that interlock batteries of scales into automatic control systems. Photos. *Toledo Scale Corp.*

9—Mounted Wheels. This 4-pager (No. 1505) illustrates (in full size) "a mounted wheel for every job." There are 200 standard sizes and 86 standard shapes in a variety of bonds —vitrified, resinoid, etc. *Chicago Wheel & Mfg. Co.*

10—Presses. Catalog No. 1014 (20 pages) describes open-back, inclinable presses. Come with either gear or flywheel drive; capacities range from 7 to 100 tons. New specialty machine—"Flying cutoff." *Federal Press Co.*

INSTRUMENTS AND CONTROLS

11—Digital Demand Recorder. Here's a 16-page catalog (35A1000) that discusses an impulse counting and recording device. In addition to recording data for load survey studies, applications include production control and traffic counting. Photos. *Fischer & Porter Co.*

12—Optical Equipment. This 96-page catalog (No. 589) lists and illustrates hundreds of quality control aids—measuring magnifiers, microscopes, comparators, other instruments and components. Includes technical data. *Edmund Scientific Co.*

13—Centralized Control Systems. "From Concept to Construction" is a 16-page bulletin (No. 106) that describes company's approach to centralized control. Services include system evaluation, instrument selection, etc. *Panellit, Inc.*

14—Panel Control Systems. Prewind, pre-tested systems for automatic oil, gas or dual-fuel burners in industrial boiler installations are presented in this 4-page catalog (No. 5803-A). Gives technical data. *Iron Fireman Mfg. Co.*

15—Temperature Indicator Monitor. Bulletin MSP-155 (4 pages) discusses electronic monitor—switching, amplifying, off-normal alarms, power supply, and basic design parameters. Has specs, other data. *Hagan Chemicals & Controls, Inc.*

16—Gages. Catalog No. 338 (8 pages) covers remote-reading liquid-level gages, including standard, Red Flasher, and inclined styles. These are for boilers, deaerating vessels, water and storage tanks. *Jerguson Gage & Valve Co.*

17—Batch Mixing Control Panel. An automated "Select-O-Weigh" proportioning system for a custom rubber production service is described in 6-page bulletin (No. 715). Control panel is the "brain" of the system. *Richardson Scale Co.*

18—Pressure Gages. How these pressure instruments work, types of systems, applications, and other info make up this illustrated 36-page catalog (DH-65). Includes accessories, specs, dimensional drawings. *American Chain & Cable Co.*

MATERIALS HANDLING

19—Casters. Here's an illustrated 16-pager that tells about spring-mounted casters and suspension systems. Gives comparative load-deflection curves and other technical data. Applications, drawings, photos. *Modern Caster Co.*

20—Cranes. Bulletin DH-445B (8 pages) covers Type B-514 top-running, single-bridge, motor-driven cranes for floor-controlled applications. Capacities from 1 to 10 tons; spans up to 50 ft. Specs, photos. *American Chain & Cable Co.*

21—Oscillating Conveyors. This illustrated 24-page catalog (No. 2744) describes three conveyors

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that range from the lightest to the heaviest capacities. Info on trough widths, depths, selection, applications. *Link-Belt Co.*

22—Roller and Wheel Conveyors. Construction and application info for two types of conveyors are presented in 10-pager (MHC58). Discusses selection of wheel conveyor versus flip-out roller style. *Conveyor Systems, Inc.*

23—Casters and Wheels. This handy-size 192-page catalog (No. 65) covers company's new casters, tires, wheels, and accessories. Includes specs, dimensional data, diagrams, photos. *Darnell Corp. Ltd.*

24—Parts Feeders. Catalog P. O. 48893 has 16 pages of info about vibratory feeders for the automatic, oriented, rate-controlled feeding of small, hard-to-handle parts. Provides data on components and accessories. *Syntron Co.*

25—Sling Chains. Bulletin A is a 20-pager that lists specs for standard, single, double, triple, quadruple branch, and other types of slings. Includes suggestions for use, care, safety, and inspection. Photos, drawings. *The McKay Co.*

AUXILIARY

26—Motor Pumps. This 8-page bulletin (Form 70022) tells about 20 sizes of motor pumps that are available "off-the-shelf." In sizes ⅓ through 25 hp., for heads to 190 ft., and capacities to 775 gpm. Other data. *Ingersoll-Rand Co.*

27—Water Chillers. Three illustrated 8-page catalogs: No. 534 covers model DE packaged units from 20 to 125 tons; No. 535, model HE chillers 20 through 60 tons; No. 515, model RG ranges from 3 through 30 tons. *Acme Industries.*

28—Water Heating Convertors. Construction and operating data for hot water convertors are given in Bulletin 303-A (12 pages). Has capacity and dimension table diagrams; lists other equipment. Photos. *Patterson-Kelley Co., Inc.*

29—Dust Collector. Here's a 24-page application handbook, "Industry Relies on Dustube Collectors for Efficient Dust and Fume Control." Sections on dust and fume problems solved in metal-working, etc. *Wheelabrator Corp.*

30—Blowers and Pumps. How units of these rotary positive pressure blowers and gas pumps solve air and gas handling problems is subject of 8-page illustrated bulletin (S-59G). Chart with performance examples. *Sutorbilt Corp.*

31—Compressed Air Filters. Bulletin GEO-507 (4 pages) describes filters that remove moisture, oil, microscopic rust, dust, and scale from air lines. Has table, curve chart of flow characteristics, photos. *Commercial Filters Corp.*

32—Draft Gages. The what, where, how, and why of draft as it effects efficiency of combustion is covered in a 20-pager (No. 58-S201). Gives details about gages for measurement of low pressure, draft, and differential. *The Hays Corp.*

33—Air Conditioning. Maker's new line of conditioners are discussed in illustrated 12-pager (No. 9327). Includes major components such as coils, fans, drain pans, etc. Lists cooling ratings. *American-Standard, American Blower Div.*

34—Heating, Ventilating Units. Here's a 20-page bulletin (No. 910) about units available in 12 sizes with capacities from 600 to 73,000 cfm. Includes coil selection info, capacity tables, charts, etc. *American Air Filter Co., Inc.*

35—Panel Filters. Bulletin B-100-2B (4 pages) describes high-velocity panel impingement filters. Details space requirements, dirt-holding capacity, maintenance expense. Has chart, photos, diagrams. *Farr Co.*

36—Pumps. Bulletin LV758 (4 pages) describes general ceramics LV Series pumps with heads to 180 ft. and capacities to 600 gpm. Includes info about rigid cast iron base, pump cover, other details. Photos. *General Ceramics Corp.*

37—Fuel Burning Systems. This illustrated 4-color, 8-page bulletin (No. 1255) tells about eleven sizes of oil, gas, and combination gas and oil burners for firing boilers. Details of operation, burner arrangements, etc. *Orr & Sembower, Inc.*

ELECTRICAL

38—Rectifier Equipment. Bulletin GEA-6849 (12 pages) presents completely self-contained, metal-enclosed power rectifier unit substations for various applications. Components info, cost curves, photos. *General Electric Co.*

39—Heavy-Duty Limit Switches. Three types of switches are shown in 16-pager (No. 84): plug-in "200LS" series for quick replaceability; compact "LS" series; rugged "ML" switches in regular or explosion-proof types. *Micro Switch.*

40—Underfloor Raceways. This 52-page catalog has info on just about every type of underfloor distribution system. Includes service fittings, boxes, and saddle supports. Illustrated. *National Electric Products Corp.*

41—Metalclad Switchgear. Indoor, standard, and walk-in outdoor types of equipment are discussed in 24-page bulletin (No. 2804-1A). Has panel layouts, dimensions, specs, schematic drawings, charts, photos. *I-T-E Circuit Breaker Co.*

42—Pancake Motor. Here's a pancake not for eating—it's a flange-type motor of radial air-gap design (described in 4-pager No. 2150). New drip-proof pancake model reduces motor length up to 54% over other types. *The Louis Allis Co.*

43—Automatic Tension Control. This 4-page illustrated bulletin (No. 3625) tells about automatic control for precision regulation of tension in the reeling and re-reeling of wire, cable, cordage, tape, and sheeting. *Diehl Mfg. Co.*

44—Motor Generator Sets. Bulletin No. 307 (6 pages) presents 400-cycle power packages that include unit-

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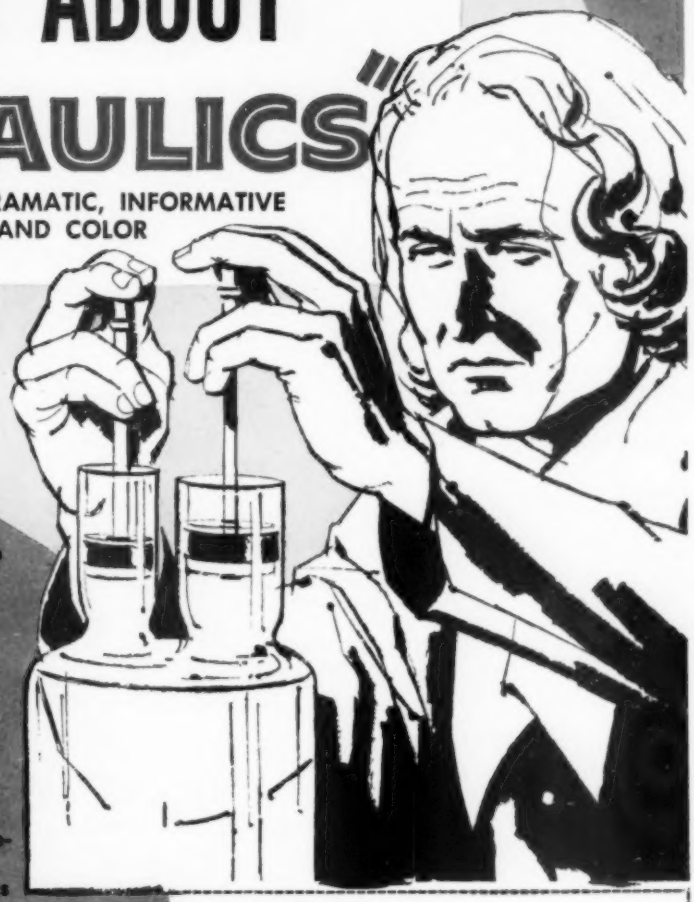

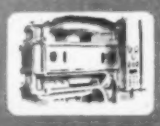

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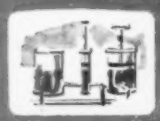

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TEXACO

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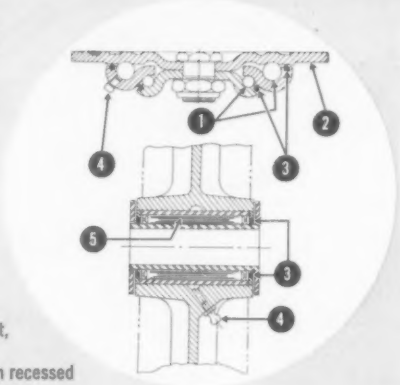
INDUSTRY'S MOST VERSATILE CASTER!

Precision Engineered COLSON PRESSWELD CASTERS

COLSON PRESSWELD! Industry's most preferred caster for versatility and service. Ideal for racks, box and platform trucks, dollies, and for all types of special applications. COLSON "floor conditioned" PRESSWELD casters offer the most complete range of wheel types and diameters to assure maximum rolling performance of loads up to 1500 pounds per caster.



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Specify COLSON PRESSWELD for your next casters . . . test their service, economy, and versatility for your needs.

Over 2,000 types of precision-engineered COLSON casters are at your service . . . offering you near-custom fitting at mass production prices. Available are types for light, medium, heavy-duty jobs; for all floor conditions and all weight and speed requirements. Every one is designed to save you money, manpower, and time. Your COLSON representative will help you select the perfect caster for your particular need. See him soon, or send for a free COLSON catalog.

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FACTORY / CATALOG NEWS

Begins on page 200

For more about these items, circle item numbers on Reader Service Card next to back cover.

mounted motor, inductor-alternator, and controls. Has construction, operating, dimensional data; photos. *Safety Industries, Inc.*

45—A-C Generators. Illustrated 16-page bulletin describes explosion-resistant brushless alternators. Machines come in single-bearing or two-bearing close coupled design. Includes table of sizes and speeds for each. *Kato Engineering Co.*

BUILDING AND EQUIPMENT

46—Power Groove Lighting. Booklet, "21 Industrial Lighting Problems Solved with Power Groove," presents case histories showing how these lamps light everything from a junk-yard to electronic assembly work. *General Electric Co.*

47—Sub-Floor Panels. How to select proper steel flooring is told in a 4-pager (2b, Ame.). Panels combine high strength with light weight. When used as sub-flooring, cellular panels act as raceways for wiring. *Bowman Steel Corp.*

48—Tank Insulation. Here's a 4-page catalog that describes way to install insulation and jacketing on large storage tanks for hot materials. Shows how insulated end-welded studs are applied to tanks. *Nelson Stud Welding.*

49—Drainage Products. This 12-page catalog (10658) gives data on corrugated metal pipe and pipe-arch, multi-plate pipe, water control gates, other equipment. Has gage table, application photos. *Armco Drainage & Metal Products, Inc.*

50—Locks. Here are specs, recommended uses, drawings, and color photos of locks and escutcheons. Heavy-duty lock features one-piece cold forged knobs, brass retractors, aluminum housings, large spindle bearings. *Challenger Lock Co.*

Turn the page

For more facts Circle 574 on Reader Service Card

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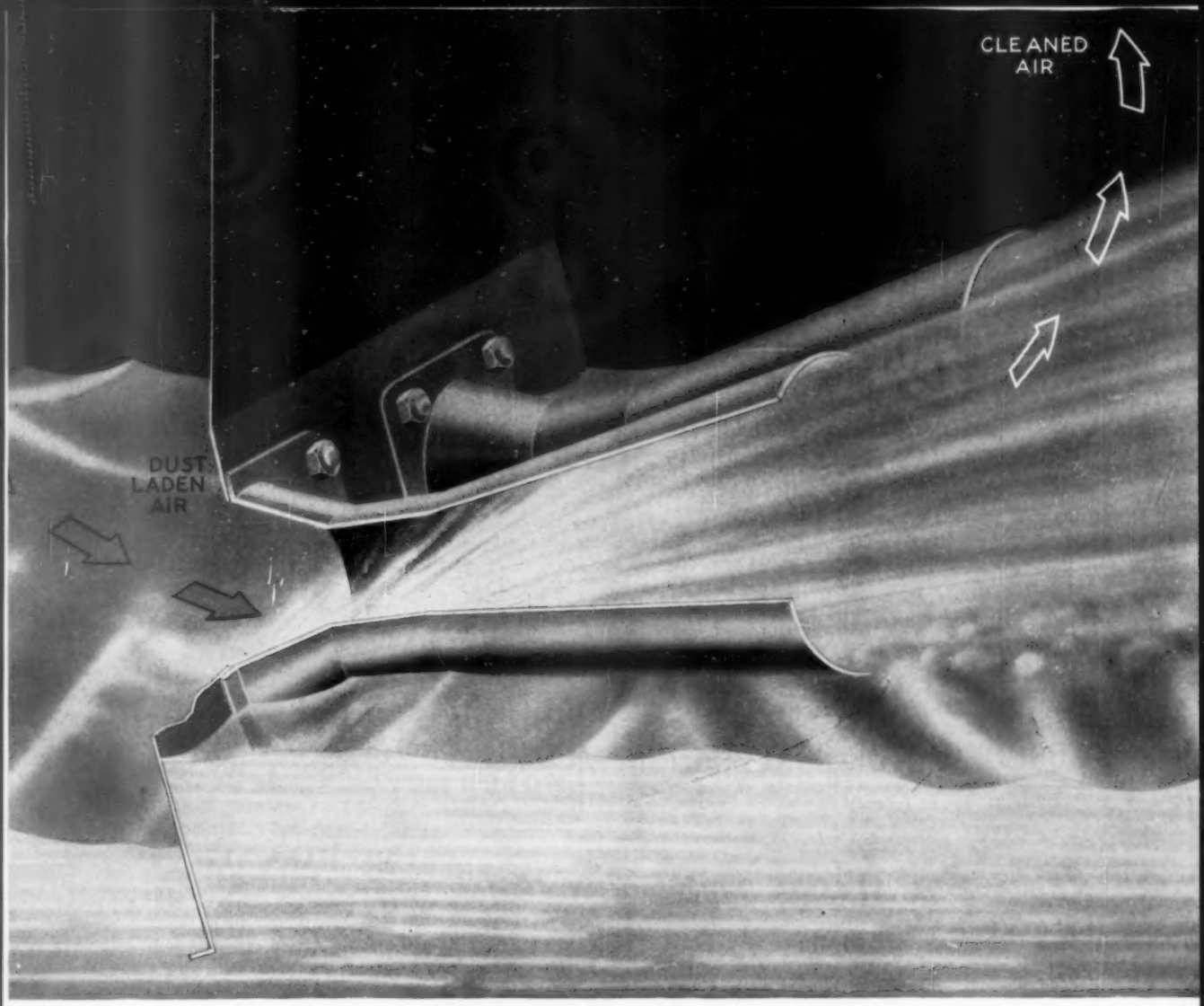
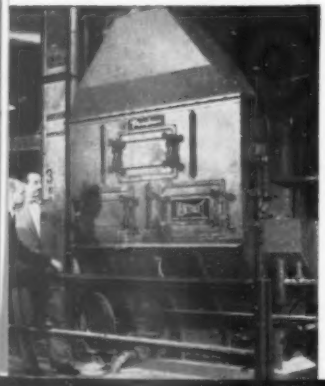


Puts the squeeze on difficult dusts

Pangborn Ventrijet Wet Dust Collector uses exclusive venturi tubes for peak efficiency

Pangborn Ventrijet Wet Dust Collector on the job. This is just one of Pangborn's comprehensive line of wet and dry dust collectors.



That pinch-necked venturi tube is the secret behind Pangborn Ventrijet performance. As dust-laden air flows through these tubes, the constriction creates a low-pressure area which draws water into the air stream. The resulting turbulence breaks the water into particles which actually *wash* the dust from the air. The simplicity of Ventrijet design saves money in its ease of installation, its low cost of operation and maintenance.

Although the Ventrijet is particularly suited to collecting hot, moist, inflammable, corrosive and obnoxious dusts, the Pangborn engineering it typifies is important to *any* dust-producing plant. It is not enough to put a dust collector within a plant. An efficient dust control system must be *scientifically* planned, designed and constructed to handle effectively a specific dust problem. This thinking is incorporated into every Pangborn proposal.

The Pangborn Engineer in your area will be glad to go to work for you. He is a dust expert *and will discuss your individual problem at no obligation. And, for more information, write for Bulletin 922 to:* Pangborn Corp., *2100 Pangborn Blvd., Hagerstown, Md. Manufacturers of Dust Control and Blast Cleaning Equipment.*

Pangborn CONTROLS DUST

BROOK TOTALLY ENCLOSED, FAN COOLED, MOTOR DRIVES INCINERATOR DRAFT FAN.

An ideal application for this 30 HP Brook Totally Enclosed, Fan Cooled, Slip Ring Motor—built to resist heat or cold, dust, fumes, moisture. It is driving an induced draft fan handling washed flue gas and raw air at 350°F. in an American Incinerator Corp. system processing municipal waste. Brook A.C. Motors are winning praise in every industry for dependable service and overall economy. They can save for you! Warehouses, Sales Representatives, Dealers throughout the country. Send for literature.

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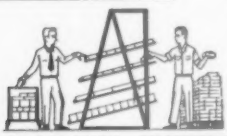

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FACTORY / CATALOG NEWS

Begins on page 200

For more about these items, circle item numbers on Reader Service Card next to back cover.

51—Ceiling Lighting Systems. Three 6-page catalogs: No. 620 presents easy-to-install area illumination; No. 610B describes five sizes of preassembled modular units; No. 800B covers wall-to-wall lighting systems. *Smithcraft Lighting.*

52—Wrought Iron Pipe. Booklet, "4-D Wrought Iron for Building Drainage Systems" (64 pages), discusses piping for soil, waste, vent, downspout applications. Gives results of surveys, photos of vent corrosion. *A. M. Byers Co.*

53—Lighting Fixtures. This 4-color, 8-page catalog (File 4) presents advantages of color-coding luminaires to help protect and direct workers. "Kolorkoded" red, green, yellow units identify exits, aisles, etc. *Edwin F. Guth Co.*

MECHANICAL

54—Speed Reducers. Here's a 4-pager (No. 20B9053) that describes shaft-mounted reducers with output speeds of 40 to 400 rpm. and hp. ranges ½ to 40. Cutaway drawing shows components. Photos of applications. *Allis-Chalmers Mfg. Co.*

55—Air Motors. This illustrated 16-page catalog (Form 5072A) features over one hundred motors that cover power ranges from 0.3 to 24 hp. Speeds from 50 to 2580 rpm. at rated hp. Specs, photos, dimensional drawings. *Ingersoll-Rand.*

56—Drive Belts. How to make an endless belt is shown in this 6-pager. Gives other info about all-synthetic belting for modern drives. Drawings; table of hp. ratings. *J. E. Rhoads & Sons.*

57—Mechanical Seals. Precision shaft seals for all makes, models, sizes of centrifugal pumps are discussed in this illustrated 4-pager. Seals comes in standard types and sizes, or engineered to specific needs. *Borg-Warner Corp.*

Turn the page

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first in silicones

Dow Corning

SILICONE NEWS

production and maintenance edition • No. 27

POUR YOUR OWN RUBBER PARTS

What is it . . . a giant jar rubber? Actually, the item in the picture is an outsize, heat resistant seal of silicone rubber, and it costs only $1.25 in materials. That's because this company—Tru-Scale Inc. of Wichita—makes seals for prototype molds in the simple plywood rig shown. You can do the same.

The seal is made of Silastic® RTV, the Dow Corning silicone rubber that vulcanizes at room temperature. Supplied as liquids, a variety of Silastic RTV's are available . . . some set up in a few minutes, others require 24 hours. No ovens, presses or expensive fixtures are needed.

Before they hit on Silastic RTV, Tru-Scale had a problem. They needed special seals for the compression and vacuum molds in which they made polyester-glass parts. Because the parts were prototypes, not production runs, each set of molds was used but briefly. Too briefly to justify the expense of having any seals custom-molded.

Tru-Scale's production people tried various mastics, but these deteriorated on contact with the polyester resin. Then they discovered how easy it was to make seals of Silastic RTV. They just routed a groove of the right size out of a piece of birch-faced plywood. They sanded it, filled the grain like any good do-it-yourselfer, and rubbed on some plain wax for smooth release. Next, they poured the groove full of Silastic RTV, and let it set overnight. Following day, they removed the solid part, trimmed off excess, and behold . . . a D-ring ready to go!

With this easy method, Tru-Scale produces seals up to 48 inches in diameter and ¼" by ¾" cross-section. A typical 24 inch ring costs about $1.25 in material. As for heat resistance, some of the rings have seen as much as 30 molding cycles to date with no sign of trouble.

Needless to say, countless other shapes could be made in much the same way. The "mold" needn't be plywood . . . it could be almost any workable material, including plaster-of-paris or even modeling clay. Also, Silastic RTV is fine for jigs, fixtures or molds. Or coating. Or potting. Try it!

No. 278

NO RUST IN 3 YEARS

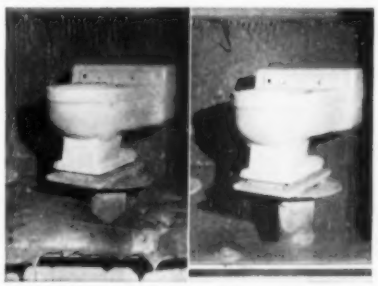
Like car mufflers, exhaust mufflers on plant engines are prone to rust. The reason? Most paints can't stand the exhaust heat . . . peel off, leaving the muffler bare. The same corrosion problem, of course, exists with other hot plant equipment. Here's what you can do about it.

At the gas plant shown, the exhaust mufflers were simply too hot . . . 700 F . . . for ordinary paint. Rather than allow the mufflers to rust, plant engineers had them repainted regularly. But repainting was expensive.

Then they tried a new type of paint. Called Rust-Ban, this paint is based on Dow Corning silicone resins and zinc dust pigments, and is produced by the Humble Oil and Refining Company of Houston. First the stacks were sand-blasted clean, then primed and finished with Rust-Ban. Total film thickness was less than 2.5 mils.

Result? After more than three years of continuous services at temperatures to 700 F, the paint showed no signs of peeling. This was a far longer period than any paint had lasted previously. Other plant areas such as boiler stacks, when coated with Rust-Ban, showed the same results. Quite a performance!

No. 279



DOWN WITH FOAM!

The word "foam" doesn't sound very menacing, does it? Yet when you think of the work stoppages, mess, fire and health hazards, extra clean-up time and other evils it creates for industry, foam looks formidable indeed. Here's how one plant eliminated this trouble maker. (Cont. Pg. 2)

FOR DATA RELATING TO THESE ARTICLES, CIRCLE REFERENCE NUMBER IN COUPON ON NEXT PAGE

MORE

THESE MOTORS DO THE "HEAT TRICK"

Can you expect reliable service from motors operating in 300 F ambients? You can if the motor windings are insulated with silicones. Harvey Aluminum, The Dalles, Oregon, supplies a confirming story.

At the Harvey Aluminum reduction plant, 960 motors feed carbon anodes into electrolytic cells. These 2 and 3-hp motors must withstand operating temperatures as high as 300 F, plus the extra internal heat developed by the start-and-stop nature of the process. A really rough assignment for any motor. But they take the strain and keep right on running.

Why?

Because Harvey Aluminum had the foresight to specify silicone insulation for all 960 of these motors, which were built and designed by Reliance Electric and Engineering Co., Cleveland. Environments that would quickly cause many insulating materials to fail do not harm silicones. Extreme heat, moisture, and corrosive atmospheres have little effect on the dependability of silicone insulated equipment. Such equipment provided more than enough thermal stability to meet the tough conditions at Harvey Aluminum.

Many other plants, too, depend on silicone insulation to eliminate motor downtime and cut maintenance costs. Have you investigated the possibilities? *No. 280*

ANTIFOAM *(Continued)*

Case Manufacturing Corporation of Robinson, Illinois, produces bathroom fixtures, such as lavatories and water closets. One of the steps in the manufacturing process is spraying glaze on the units previous to firing.

Case's foam problem arose in the spray booth. The water solution of material used as a glaze binder foamed so rapidly that shut-downs for cleaning were often needed. Plant engineers managed to stop the foam with an octyl alcohol defoamer, but this involved further trouble. Octyl alcohol has a decidedly unpleasant odor, and it tended to cause skin irritation. More problems!

Then, early in 1957, Case experimented with Antifoam B, a Dow Corning silicone defoamer. It worked wonders! No more foam, no more odor, no more skin rash, no more problems. As a result, they've been using Antifoam B ever since.

If foam is causing troubles anywhere in your plant, look into the Dow Corning Silicone Antifoams . . . they can do wonders for little cost. *No. 281*

new literature and technical data on silicones

THREE LITTLE WORDS, *Dow Corning defoamers,* are travelling fast among asphalt producers, contractors, and end users. They have found that as little as 1 part per million of Dow Corning defoamer offers new handling ease and economy for processing hot asphalt. A new data sheet explains how foaming problems can be overcome and how valuable processing, shipping, and storage space is freed to increase output with a surprisingly small amount of Dow Corning defoamers. . . . . *No. 282*

START THE NEW YEAR with Dow Corning's 1959 Guide to silicone products. It contains data and application descriptions on 150 readily obtainable silicone materials that can be the solution to some of your production and maintenance problems. Thumb through a copy. . . *No. 283*

LONGER VALVE LIFE and less maintenance are obtained through the use of Dow Corning Valve Seal where extreme temperatures, corrosive chemicals or steam create problems. Physiologically harmless, Dow Corning Valve Seal is used in food processing lines and pharmaceutical production systems. It's also noncorrosive to metals and has no swelling effect on rubber or plastics. A reprint from MAINTENANCE provides more details on properties and applications. . . . . *No. 284*

SLIP OFF WITH SYL-OFF. These Dow Corning silicone paper coatings are real time and temper savers when handling products like asphalt, candy, gum, adhesives, unvulcanized rubber, latex, foods, and other sticky products. A four-page illustrated brochure gives details on the available paper, paperboard, liners, wrappers, and packaging containers treated with Syl-off. *No. 285*

FIVE FAVOR 5 . . . Five big benefits of Dow Corning 5 Compound and how it protects insulators from contamination, eliminates service failures due to flashovers and leakage, are listed in a compact brochure. The original full voltage rating of your insulators can be maintained longer—even under the most adverse atmospheric conditions. The brochure explains how cleaning and maintenance are reduced to a minimum effort, and there are many additional points that you will find of interest. Ask for bulletin *No. 286*

PROTECT MASONRY with water repellents based on Dow Corning Silicones. Give lasting protection to above-grade block, brick, concrete, stone, stucco and many other surfaces. These silicone treatments are easily applied and do not discolor. They help keep masonry clean by keeping water out—reducing efflorescence, cracking and spalling. Descriptive brochure containing complete information is available now. . . *No. 287*

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FACTORY / CATALOG NEWS

Begins on page 200

For more about these items, circle item numbers on Reader Service Card next to back cover.

58—Variable Speed Drives. Two catalogs: No. S-790 gives specs and other data on drives from 1/15 to 1/8 hp.; No. S-580, data on drives 1/4 to 1½ hp. Both include control arrangements, circuit descriptions. *Magnetic Amplifiers, Inc.*

MISCELLANEOUS

59—Water Coolers. Catalog No. 59 (20 pages) shows many models of electric coolers—standard, compact, hot-cold, explosion-proof, refrigerator storage. Tells how to select right cooler, best location sites, etc. *Cordley & Hayes.*

60—Whiteprint Equipment. This 16-page guide discusses applications and includes photos of latest equipment. Has specs and other data on the Bambino, Ozamatic, Streamliner, and Printmaster machines. *General Aniline and Film Corp.*

61—Printing on Corrugated. No. 8 in company's Little Packaging Library series is titled "How to Use Printing on Corrugated." Explains phases of printing from the basic box design, selection of board, typography, etc. *Hinde & Dauch.*

62—Waste Treatment. Catalog 171-113 (24 pages) describes Dowpac—what it is, what it has, what it does. Application photos, technical tables, oxidation comparisons. Construction, installation sequence. *Dow Chemical Co.*

63—Margin Master Binders. Here's a 6-page brochure (No. S-561-R) about binders for marginally punched forms. One model, for unburst forms, permits housing directly from tabulation machine. Photos. *Royal McBee Corp.*

64—Air Express. Here's a 4-page catalog that tells you when you need to ship by air express. Discusses "increasing demand," "upturning curve" and "leveling off" of production—and how to keep inventories in balance. *Air Express.*

Low-cost, scientific treatment brings lasting concrete beauty

You'll brighten up the entire area when you transform a drab, dingy concrete floor into an attractive, colorful, easy-to-maintain surface of which you and your workers can be proud.

For new or old concrete

The famous MULTI-CLEAN METHOD of floor care is a complete, scientific program for both new and old concrete. It calls for the *right materials*, the *right equipment*, and the *right technique*.

Under the MULTI-CLEAN METHOD your concrete floors are cleaned, hardened, and dustproofed. They are given an attractive finish in a choice of clear or seven nonfading colors . . . *they are easy to maintain*, and resist abrasion, water, acids, alkalis, grease, oils, soaps, and a wide variety of solvents.

And besides providing an attractive, long wearing surface, the scientific MULTI-CLEAN METHOD will save you many hours of time and many gallons of maintenance materials.

New folder describes Method

The complete MULTI-CLEAN METHOD for initial treatment of new or old concrete, low-cost maintenance, and restoration of floors that have previously been painted or sealed is described, step-by-step, in new folder, "*Multi-Clean Method For Maintaining Your Concrete Floors*", and in a sound strip film.

For your free copy, or for information on the MULTI-CLEAN METHOD for any other common type floor, call your local MULTI-CLEAN Distributor or mail the coupon below. You will be under no obligation, of course.

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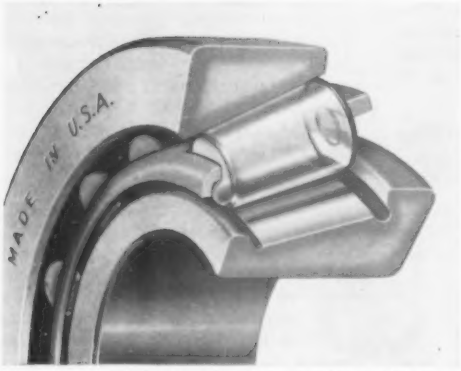
Bower mows down sub-miniature "mountains" to fight wear, stretch roller-bearing life



Bower Tapered Roller Bearings are *Spher-O-Honed:* 1. Roller heads are spherically contour-ground, need no "run-in"; 2. Oil groove is bigger for positive roller-head lubrication; 3. Honing superfinishes inner and outer races for longer life.

Bower hones bearings to reduce friction, save you money on machine downtime and replacement costs

Finish grinding of bearing raceways still leaves minute surface blemishes—"mountains" under magnification. So Bower takes a costly extra step . . . uses a honing process to smooth off these microscopic mountains.

Super-finished raceways offer less resistance to rollers. This reduced friction naturally results in less wear and longer life. Bower tapered roller bearings need no initial "run-in". You get more production time from your machines . . . save on bearings and, more important, the costly labor it takes to replace them.

Your Bower bearing specialist can give you fast delivery on his complete line of tapered and straight roller bearings. Call him when you need replacements!

BOWER ROLLER BEARINGS

FEDERAL-MOGUL SERVICE

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 13, MICHIGAN

BEARING BOWER ROLLER BEARINGS SERVICE

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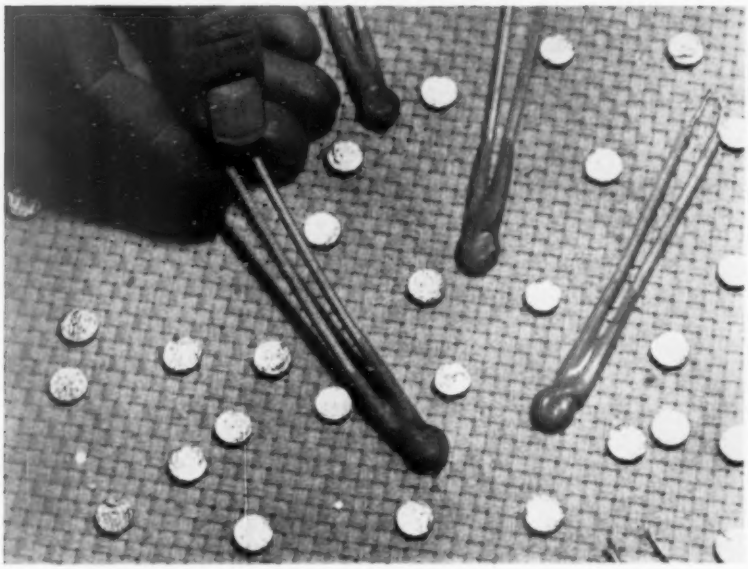


253—Duct Insulation of spun mineral wool is faced on one side with embossed aluminum foil 0.0025-in. thick. Provides vapor barrier that meets fireproof building requirements. Is also an attractive finish for exposed ducts. Lightweight, easy to use. *Baldwin-Hill Co.*

254—Iron Powder Electrode, called Mangjet, is said to reduce cost and provide easier operation in welding 12-14% manganese steels. It's a low hydrogen electrode with high deposit rates, smooth beads, a steady arc. For a-c and d-c welding machines. *Lincoln Electric Co.*

Switching Devices Protect Motors

These are tiny devices with a long name that tells what they do.

Positive temperature coefficient thermistors are contactless thermal switches. They're said to fill the need for a practical, reliable, precise system for over-temperature protection of hermetic motors. Can be used where bi-metallic temperature-sensing elements are impractical. Thermistors are small ceramic disks, about the size of aspirin tablets, surfaced on opposite faces with a metallic coating. Before use they are fitted with leads and encapsulated in an epoxy resin.

Westinghouse Electric Corp. (Circle 251)

Synthetic Joins New Cement to Old

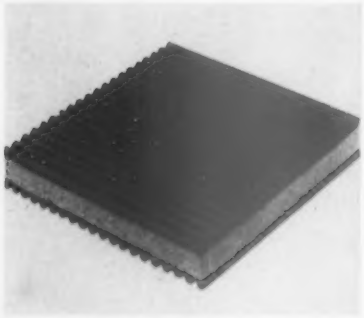
Here's a new structural welding agent (photo at right) that bonds fresh wet concrete to cured concrete. Called Uniweld, it is an "alloy" of epoxy and nylon-type synthetic resins. Forms a permanent joint and water and vapor barrier—welds the entire contact area without mechanical interlocking. Material is thermosetting, not thermoplastic. Here's how to use: The two components are mixed in equal volume, then a thin coating is applied by roller, brush, or spray. Fresh concrete is poured directly on the Uniweld about 15 minutes later. In general, a gallon will cover up to 200 square feet. *Permagile Corp. of America* (Circle 252)

Self-Insulating Pipe

The self-insulating piping that's shown above is for both hot and cooled air. It consists of a wall of heat-resistant urethane foam in which a coil of wire is embedded to increase structural stability. Inner lining is of aluminum foil to increase heat reflectance. The whole structure is covered by heat-sealed polyethylene film that prevents deterioration by water in the soil. Pipe size, inner lining, and outer covering can be varied to fit your range of applications. *Standard Plastics, Inc.* (Circle 255)

Turn the page

For more about these items, circle numbers on Reader Service Card next to back cover.



256—Mounting Pads of neoprene, called PadZorbers, are said to reduce vibration transmission by up to 80%; prevent machine travel and deaden noise. The 18x18-in. ribbed sheets can be cut to any shape to fit under feet of presses, lathes, etc. *T. R. Finn & Co.*

257—Diethers, a new series of lubricants and fluids, impart viscosity-temperature characteristics to formulations of greases, hydraulic oils, power transmission fluids, gear oils. DLB Series comes in three different viscosity grades. *Union Carbide Chemicals Co.*

258—Saran Rope is said to be resistant to almost all liquids. It's an extruded thermoplastic material made from petroleum and brine. For operations where chemical action shortens the normal life of a fiber rope. Non-water absorbent, non-flammable. *Columbian Rope Co.*

259—Fuel Oil Treatment, Formula C-8, makes it possible for soot to be burned and discharged to the atmosphere, eliminating need to shut down a plant while the soot is dug out. Material is fed into fuel oil storage tanks just prior to delivery of the oil. *Bird-Archer Co.*

260—Micaceous Segment Plate minimizes motor failures due to splitting of segments or loosening of commutator bars. Called Isomica No. 2080-5, the material is extremely uniform, especially in the distribution of the shellac bonding agent. *Minnesota Mining & Mfg. Co.*

261—Weldable Alloy is a metal that can be used for highly stressed parts at temperatures up to 1050 F. where joining is a problem. Maker says that in the annealed condition, this steel is easily blanked, drawn, formed, or cold-headed. *The Carpenter Steel Co.*

262—Flat Paper Strapping material is said to be tough enough to substitute for steel strapping in some applications—at half the cost. Has up to 300-lb. tensile strength, is light, easily cut, does not rust or mar materials. For boxes and bales. *Zellerbach Paper Co.*

263—Synthetic Chamois, not from an animal, is made chiefly of oil and solvent-proof nitrile rubber and can be used for cleaning wherever natural chamois is desirable. Known as Chamie-Tex, it is not harmed by grease, oil, or solvents. *Milwaukee Dustless Brush Co.*

264—White Alumina Powder with a guaranteed maximum total iron content of 0.04% as ferric oxide is now available. Pure and of uniformly fine particle size. For use in refractories and ceramics; as abrasive in buffing and polishing hard surfaces. *Reynolds Metals Co.*

265—Conductive Coating, Hysol 6251 is based on epoxy resins. It can be used for rebuilding areas worn away by sliding contacts and as a conductive base for plating plastics. Full cure in 48 hours at room temperature or in 7 min. at 300 F. *Houghton Laboratories, Inc.*

MATERIALS LITERATURE

266—Steel Castings. Here's a 36-page 4-color booklet entitled "The Role of Molybdenum in Steel Castings for Industrial Equipment." Discusses hardness, tensile properties, and other features. *Climax Molybdenum Co.*

267—Silicones. This 16-page 1959 Guide is said to be the most complete reference to silicones ever published. Tells how to cut production costs and simplify designs. Gives application photos, charts. *Dow Corning Corp.*

268—Formica. "Stronger than Steel, Lighter than Aluminum" is the title of 4-page catalog (Form 872). Shows, with photos, that dies of this laminated plastic, S-52, are fast and economical to make. *Formica Corp.*

269—Fireproofing. Bulletin F-10 (4 pages) describes Blaze-Shield—a blend of mineral fiber and inorganic binders for direct machine application. Includes fire-retardant ratings. *Columbia Acoustics and Fireproofing Co.*

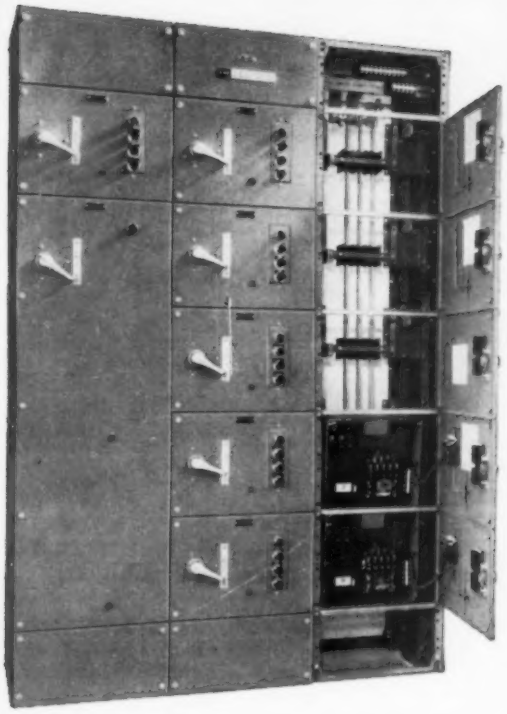
270—Fluorocarbon Plastic. Versatile material called Kel-F is the subject of this 4-pager. Tells how the plastic can solve many problems and improve performance of handling and processing equipment. *Fluoro-Plastics, Inc.*

271—Coated Steel Tubing. This 6-pager (P.O. 5558) tells about tubular products and parts that combine strength with protection against corrosion. Gives applications, thickness conversion table, photos. *Armco Steel Corp.*

272—Wood Treatments, Finishes. How Lignophol finishes can help prevent deterioration of wood exposed to traffic, abrasion, heat, etc., is discussed in 4-page brochure (BP2020). Includes application data. *L. Sonneborn Sons, Inc.*

In Control Centers...

Federal Pacific gives what you're looking for



RELIABILITY

BOLTED CONSTRUCTION—11-gauge formed channels bolted together for maximum structure rigidity.

POSITIVE PLUG-IN CONTACTS—special beryllium copper alloy stabs provide high-pressure, low-resistance unit-connections to silver-plated bus.

TESTED TO WITHSTAND 25,000 AMP RMS SHORT CIRCUIT STRESSES.

FLEXIBILITY

PREPUNCHED STRUCTURES—for unmatched job flexibility...individual units or complete sections can be added, removed or interchanged to meet varying job requirements—present and future.

COMPACT DESIGN—up to 20 units can be mounted in a single vertical section.

EASY WIRING—oversize wiring spaces simplify initial installation and facilitate change of units.

SAFETY

UP-FRONT UNIT RELEASE—completely disengages unit from energized bus... can be locked in open position to prevent accidental contact.

FULLY ENCLOSED UNITS—steel barriers isolate each unit from adjacent parts.

DOORS MOUNT ON STRUCTURE—prevent accidental contact with energized bus when starter unit is removed.

Nothing has been left to chance in the design of this control center. Structure, starters, and protective devices have all been carefully engineered, manufactured and coordinated by Federal Pacific to assure the highest standard of operating efficiency and dependability—as well as to provide unified responsibility for performance. For complete details write for Bulletin 2-2000A, Federal Pacific Electric Company, General Offices: Dept. 305, Newark 1, New Jersey.

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The Best in Electrical Distribution and Control Equipment.

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Your concrete floors "dust" away from constant traffic. This dust gets into machinery, equipment, products . . . is often tracked onto other floor surfaces. It also endangers your employees' working efficiency, moral and health.

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FM29

How to Use Our New Groupings

Here's help in getting full benefit from FACTORY's Maintenance Cost Guide, page 75 of this issue.

FACTORY'S editors have come up with a new classification system for manufacturing plants. This new system is especially designed for production and maintenance management men. Its principal use is to help our readers relate the results of surveys (such as the "Maintenance Cost Guide" on page 75) to their own plant operations.

The new system classifies all companies in a given survey or study into five groups according to general type of work performed: Heavy Process, Light Process, Heavy Fabrication, Light Fabrication, and Benchwork. The classifications are numbered 1 through 5 respectively.

These five classifications don't replace the usual classifications by products or type of industry. They supplement them, as you will see on page 75, where there are breakdowns according to both FACTORY's system and the Standard Industrial Classification (S.I.C.) system, wherein specific industry groups are used.

Our reason for adding the special FACTORY classes is simple: We want to give readers classifications that reflect the weight, size, and complexity of equipment in plants and the economic penalty incurred when production is interrupted. These are the primary factors that dictate the extent and cost of the maintenance services a plant needs.

If you'd like a detailed explanation of the new FACTORY system, see "Better Way to Compare Your Plant's Maintenance Practices," August 1958, page 138.

Now, to tell you what kinds of plants we have included in the five FACTORY classes, here's a complete listing (appearance of some industry classifications under two or more of the five FACTORY headings below indicates differences in process or in size or weight of materials or products):

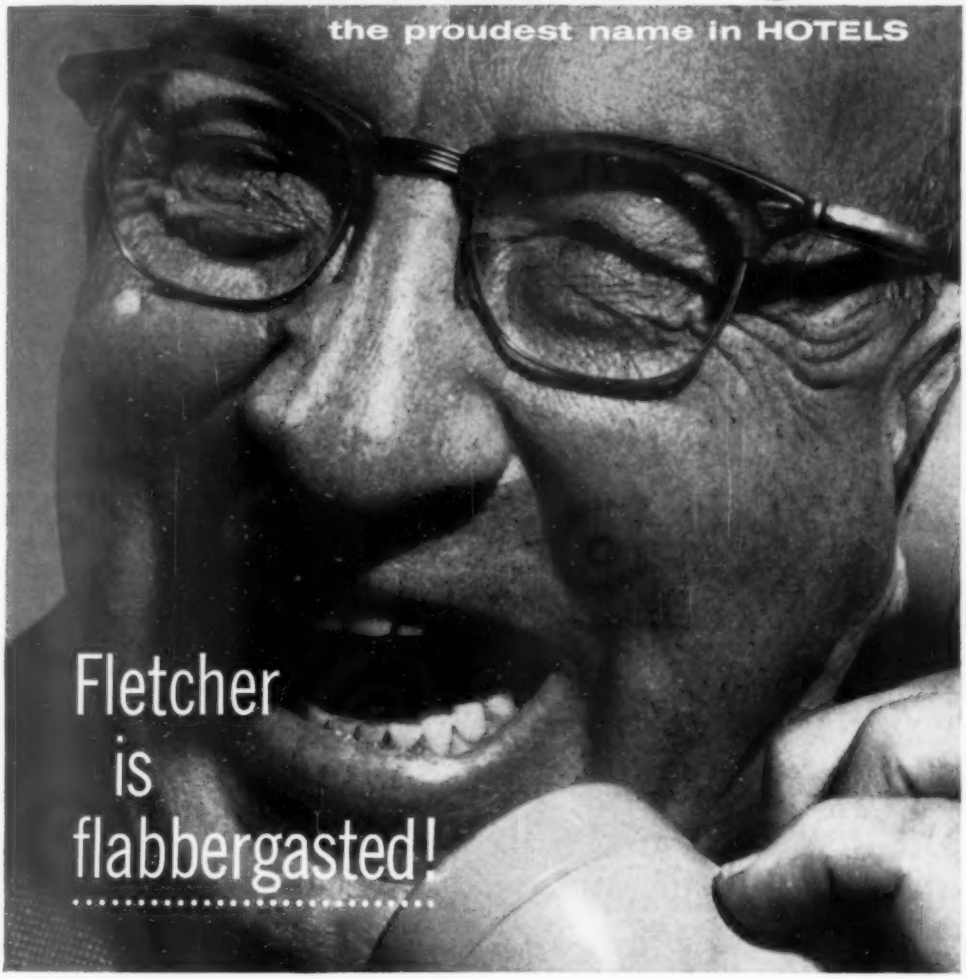
1. Heavy Process—29 petroleum refining; 24 inorganic and organic chemicals; 23 blast furnaces and steel works; 13 paper and allied products; 11 principal non-ferrous smelting and refining; 9 each—miscellaneous chemical products, rubber; 8 each—sugar, hydraulic cement; 6 agricultural chemicals; 4 each—veneer and plywood, converted paper and paperboard, cellulosic man-made fibers; 3 each—plastics and synthetic rubber and resins, gypsum and plaster products, non-metallic mineral products; 2 each—structural clay products, electrometallurgic products.

2. Light Process—18 drugs; 12 canning and preserving; 8 each—meat products, miscellaneous food preparations, flat glass; 7 each—dairy products, distilled liquors, bottled and canned soft drinks, cotton and synthetic broad fabrics; 6 each—malt liquors, wool broad fabrics, knitting mills, apparel and finished products, soap and detergents, perfume and cosmetics; 5 each—bread and bakery products, cigarettes, floor-covering mills, paints and varnishes; 4 each—flour and grain mill products, confectionery, paving and roofing materials, nonmetallic mineral products, electrometallurgic products; 3 each—cereal preparations, biscuits, tobacco and snuff, miscellaneous textile goods, miscellaneous fabricated textile products, plastics and synthetic rubber and resins, leather tanning and finishing, structural clay products, other miscellaneous manufacturing industries; 1 each—tobacco stemming and redrying, paper and allied products, converted paper and paperboard, rubber, principal nonferrous smelting and refining, medical instruments.

3. Heavy Fabrication—18 aircraft and parts; 12 motor vehicles; 11 construction and mining and material handling equipment; 10 nonferrous forming mills; 9 each—machine tools, railroad equipment; 8 pumps and compressors; 7 farm machinery; 6 each—engines and turbines, oil field machinery and equipment; 5 each—special in-

SHERATON

the proudest name in HOTELS



Which of these 39 cities is your next stop?

EAST
NEW YORK
BOSTON
WASHINGTON
PITTSBURGH
BALTIMORE
PHILADELPHIA
PROVIDENCE
ATLANTIC CITY
SPRINGFIELD, Mass.
ALBANY
ROCHESTER
BUFFALO
SYRACUSE
BINGHAMTON, N.Y.
(opens early 1959)

MIDWEST
CHICAGO
DETROIT
CLEVELAND
CINCINNATI
ST. LOUIS
OMAHA
AKRON
INDIANAPOLIS
FRENCH LICK, Ind.
RAPID CITY, S. D.
SIOUX CITY, Iowa
SIOUX FALLS, S. D.
CEDAR RAPIDS, Iowa

SOUTH
LOUISVILLE
DALLAS
(opens early 1959)
AUSTIN
MOBILE

WEST COAST
SAN FRANCISCO
LOS ANGELES
PASADENA
PORTLAND, Oregon
(opens fall 1959)

CANADA
MONTREAL
TORONTO
NIAGARA FALLS, Ont.
HAMILTON, Ont.

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RCA is the leading manufacturer of thyratron types 2050 and 2D21. These types have an enviable record of performance in demanding industrial applications. RCA-2050's and -2D21's, as well as all RCA Thyratrons, are available at your RCA Industrial Tube Distributor.

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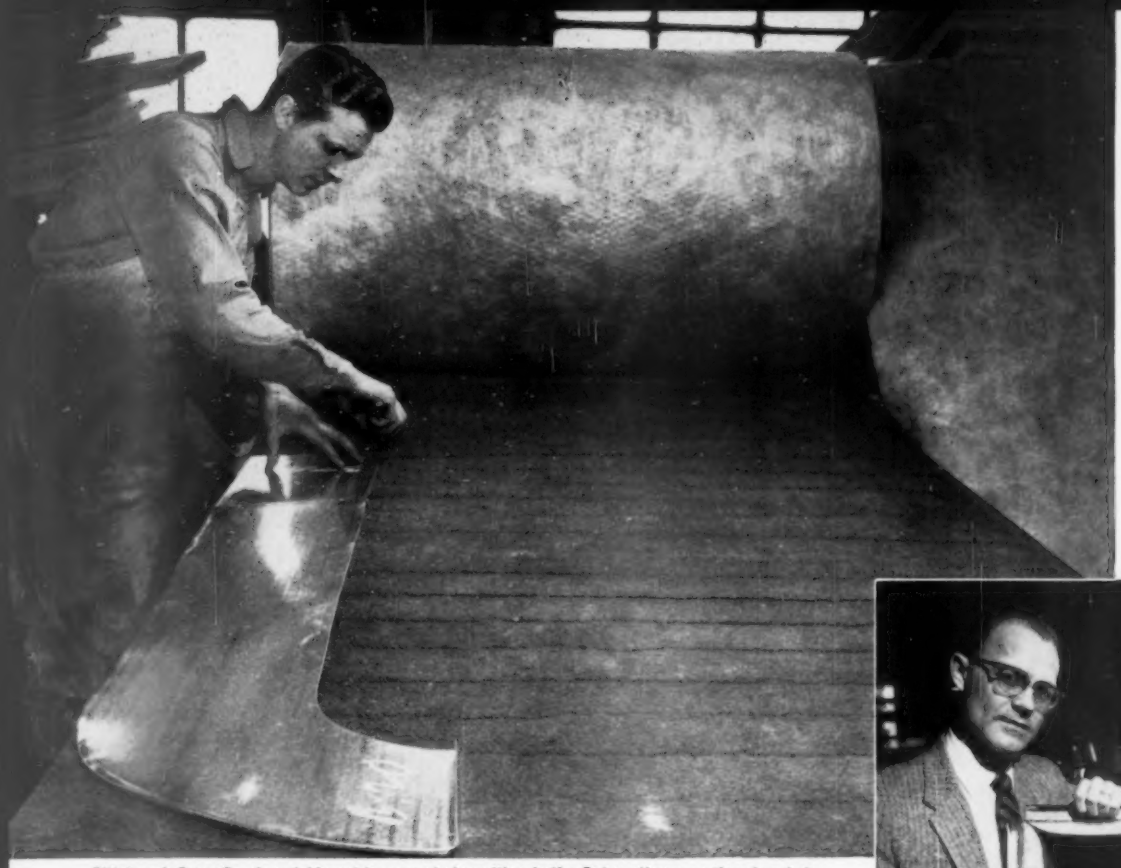
FACTORY'S PLANT GROUPS
Begins on page 214

dustrial machinery, motor vehicle parts and accessories; 4 other metalworking machinery; 3 each—iron and steel foundries, miscellaneous primary metal, fabricated structural metal, ship and boat building; 2 each—heating and plumbing, general industrial machinery, miscellaneous electrical equipment; 1 each—cutlery and hand tools and hardware, miscellaneous fabricated wire products.

4. Light Fabrication—17 motor vehicle parts and accessories; 9 printing and publishing; 8 railroad equipment; 7 household appliances; 6 each—leather footwear, electric transmission and distribution equipment, electrical industrial apparatus; 4 each—cigars, furniture, paperboard containers and boxes, cutlery and hand tools and hardware, heating and plumbing, metal stampings, machine tools, measuring and controlling and indicating instruments, miscellaneous manufacturing; 3 each—converted paper and paperboard, cans, miscellaneous fabricated metal products, special industrial machinery, ball and roller bearings, service-industry machinery, lighting and wiring equipment, aircraft and parts, toys and athletic goods, pens and pencils and office materials; 2 each—ordnance and accessories, nonmetallic mineral products, fabricated structural metal, screws and nuts and bolts, medical instruments, photographic equipment and supplies; 1 each—tobacco stemming and redrying, structural clay products, miscellaneous fabricated wire products, engines and turbines, other metalworking machinery and general industrial machinery, pumps and compressors, miscellaneous electrical equipment.

5. Benchwork—14 radio and television sets; 10 office machines; 6 each—apparel and finished products, electronic components and accessories; 5 watches and clocks; 3 each—aircraft and parts, measuring and controlling and indicating instruments; 2 each—household appliances, optical instruments and lenses, photographic equipment and supplies; 1 each—miscellaneous textile goods, electrical industrial apparatus, medical instruments, toys and athletic goods. **(END)**

For more facts Circle 585 on Reader Service Card ➤



Pittsburgh Superfine is quickly cut to correct size with a knife. Cut sections are then bonded to duct with adhesive. Extra adhesive is applied to edges of insulation to adhere them to edges of metal.

"We used one-inch, 1½-lb. density Pittsburgh Superfine Fiber Glass Insulation with a Neoprene coating to line all ducts," says Mr. George P. Fenton. "Superfine is flexible, adaptable and easy to handle."

At Greater Pittsburgh Airport's New Extension— Pittsburgh Superfine Insulates Air Conditioning Duct Work

"When our company installed the sheet metal ducts for the two air conditioning systems at Greater Pittsburgh Airport's new East Dock, we used over 7,000 sq. ft. of Pittsburgh Superfine Fiber Glass Insulation as the acoustical and thermal lining for the ducts," reports Mr. George P. Fenton, General Manager, McIlroy Sheet Metal Engineers and Fabricators, Pittsburgh, Pennsylvania.

Why Pittsburgh Superfine was specified

"This job called for an insulation that could withstand air velocities, would have proven erosion resistance, would provide good acoustical properties at minimum cost, and would insure resistance against temperature differential. Pittsburgh Superfine met all these requirements easily."

Easy to work with on the job

"We've used Pittsburgh Superfine often, and know from experience that it's flexible, adaptable, easy to handle and easy to cut. It's especially adaptable for use in irregularly curved ducts. There was not a single installation problem on the airport job that we could not handle with Superfine," concluded Mr. Fenton.

Pittsburgh Superfine Fiber Glass can help you, too!

It's rot proof, fire- esistant . . . and it's the finest insulation against heat, cold or noise you can get! Available in a variety of facings to meet your needs. For complete information, write to *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.*

PITTSBURGH SUPERFINE IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

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10,000 choices—Century Electric engineers can help you specify the right motor without having to rely on a few types to do all jobs. Century Electric makes a complete variety of integral horsepower motors. Over 10,000 types up to 400 hp. There is one for every type of equipment—transfer machines, ball mill drives, compressors, drilling machines, lathes, etc. For all operating conditions too—dusty, corrosive, explosive or moist.

Long life motors—And you get years of dependable operation from Century Electric motors. They are manufactured to rigid quality standards. Electrical tests and other checks on operating characteristics made during manufacture assure you the best motor for your money.

Application know-how—Every Century Electric sales engineer knows motor drive systems because he sells motors and nothing but motors. Often he can give you on-the-spot answers. If not, he can turn to an engineering staff that comes up with quick answers.

You can get the right motor for your equipment just by contacting your nearest Century Electric Sales Office or Authorized Distributor. A Century Electric sales engineer will be glad to help you.

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58-22

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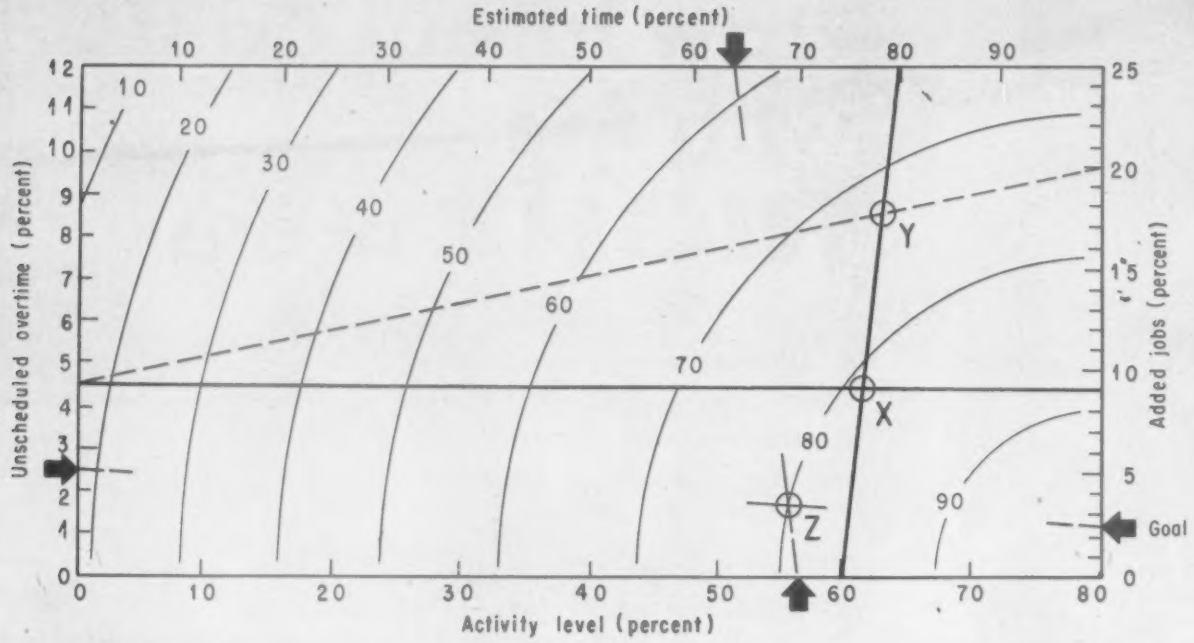
Here's Your Planned Work Index for Measuring Maintenance Jobs


Estimated time (percent)
10 20 30 40 50 60 70 80 90
Unscheduled overtime (percent)
0 1 2 3 4 5 6 7 8 9 10 11 12
Added jobs (percent)
0 5 10 15 20 25
10 20 30 40 50 60 70 80 90
X
Y
Z
Goal
0 10 20 30 40 50 60 70 80
Activity level (percent)

How to Gage Maintenance Output

Here's a simple approach to figuring performance on any maintenance job. It's uniform, gives a single, comparable answer. And it's sure-fire, too.

"X" MARKS THE SPOT. It tells on the above graph how well (or poorly) a maintenance job was done. What's more, it tells why—and what to do to improve the score. In this case the score is 81 points.

We have used this graphic tool at our Texas City plant (Union Carbide Chemicals Company) for about a year. Up to now we've applied it to all types of major maintenance jobs over 100 man-hours. Such jobs are usually multi-craft (up to 15 crafts) and complex. We have evaluated jobs grossing 7000 man-hours this way. We don't yet use it for routine jobs, even if over 100 man-hours. But we may later.

For a long time we felt the need for a simple quantitative measure of the over-all performance of a single job. We wanted a formalized index with which we could compare yesterday's performance with today's—and tomorrow's. Such an index had to be free of the whims and varieties of personal judgment. It had to be based on available statistics, not opinions or guesses.

But that wasn't all. The index had to go beyond telling us how well or poorly a job was done. It had to point to what areas needed action for improvement, what kind of action, and how much.

We believe our index fills the bill. Since its inception over-all maintenance performance has increased six points. And there have been corollary benefits toward reaching optimum maintenance at least cost. Here are the highlights:

• Less equipment downtime. The index promotes better planning, craft coordination, and hence closer man-hour estimates. This cuts repair downtime. Start-up schedules are now more reliable. Better planning minimizes the "misses" in service requirements during an overhaul. Thus we have fewer breakdowns.

• Less overtime. Because overtime is a factor in the graphic computation of the index, everybody becomes overtime-conscious.

• Lower tool and material costs. Better and more detailed planning gets the right amount of material and the right tools to the job. Hence less waste and duplication.

HOW OUR INDEX BEGAN

Our own name for this index is "Planned Work Index." This may seem to be a misnomer. But there's a good reason why we first tagged it that way. At Texas City a central group of planners handles the planning and scheduling of our major

By A. M. ROBINSON, Planning Engineer
Maintenance Planning Section
Union Carbide Chemicals Company
Texas City, Tex.

maintenance jobs. Formerly, no matter how carefully the planners worked, they never knew how close the job met expectations in the various factors of time and cost. They had no way of measuring variations or evaluating results. The only way then available was to measure "activity level," or the productivity of the working crafts. This they did by work sampling.

But work sampling was not good enough. Obviously, productivity is only a part of over-all job performance. It doesn't show up gaps in planning and scheduling, nor does it reveal other administrative or technical inefficiencies in direct supervision or staff operations. People could go on repeating the same mistakes next time. We needed something that would help spot the weak points, so they could be identified to supervision and staff.

HOW WE CHOSE THE FACTORS

In our search for an acceptable index we set down the following rigid requirements:

1. It must be simple to understand, easy to remember.

2. It must show an absolute value so that over-all performance of any job could be compared with another. And so that any group of jobs—as a class or in a given period—could be compared with another.

3. It must be presentable on a single sheet of paper. In other words, it must not include any irrelevant material that would confuse or complicate its interpretation and thus cause people to shove it aside as "more paperwork."

4. It must be universally applicable to all types of jobs.

5. All the factors chosen in its derivation must have relationship to each other as well as to the cost of the job as a whole. Cost of material, for example, is one of many factors in over-all performance, but it has no direct relationship to worker activity (one of the factors chosen for use in our computations).

It would have been easy enough to draw up a list of a dozen or more unrelated important factors affecting over-all job performance—material costs, number of breakdowns, percentage of schedule maintained, to name a few. This type of appraisal of independent factors would spotlight weaknesses, it's true. But it fails in that it would have to rely on inconsistent opinion and personal judgment in weighing the importance of each factor when they are being condensed to a single comparable score.

We finally concluded that performance of each job is measurable by these five factors: estimated man-hours, unscheduled overtime (in man-hours), added jobs (in man-hours), worker activity level, and actual time worked (in man-hours). They meet all five basic requirements. And note that each one influences the job cost. The definition and explanation of each follows:

Estimated man-hours—Total time estimated for all crafts to perform the job. A well-planned job requires an estimate. Good estimates sharpen up planning and scheduling. Poor estimates can affect activity level and cause overmanning or undermanning, disruption of jobs, increased overtime, and disruption of operating schedule.

Unscheduled overtime—Any overtime not scheduled before start of job. Sometimes it's necessary to schedule overtime beforehand because of labor agreements or because there's not enough manpower available. Unscheduled overtime usually results from bad estimates (sometimes caused by unforeseen or unavoidable difficulties), added jobs, low worker activity.

Added jobs—Unscheduled man-hours attributed to jobs not on the final work description (most often when condition of equipment cannot be predicted). These must be done while equipment is down. Added jobs result from improper planning because of lack of information. They can lower activity level because they disrupt work schedules. They can require overtime. But is it right to put the blame for a poor work description on planning? In truth, "condition is unpredictable" has long been a favorite excuse for inadequate work descriptions. And actually we have found only a few cases justifying such an excuse. The answer therefore is that planners must bear responsibility for getting proper work descriptions from operating people who originate work requests. Should the estimate be sour because of poor work description, the cause shows up under "Estimated Man-Hours" as it should. No matter how poor, some educated estimate is better than none at all.

Activity level—Percentage of productive time to total time. As a single measure, activity level gives no clue to cause of unsatisfactory job performance. But it does directly affect the degree of participation of these other factors, and it can increase or decrease their values.

Actual time—True time spent on job, including scheduled overtime and unscheduled overtime. This statistic makes it possible to reduce the three man-hour factors for any job, large or small, to a common denominator, and to interpret them on an easy scale of percentages along with "Activity Level."

We compile all these data at Texas City in the normal course of job activity. We take estimated man-hours from workload sheets prepared by planners. These are formalized detailed work descriptions and manpower, tool, and material planning sheets. Unscheduled overtime is available from accounting or payroll records or from observation. Added jobs are received from maintenance supervisors on the job or through observations by planners. Activity levels are compiled by planners or by the man who directly supervises the job, using work sampling. Actual time is taken directly from accounting records.

HOW WE BUILT THE CHART

The single "Planned Work Index" is obtained by plotting the four key factors on the rectangular chart shown on page 220. Percentage values of the four percentages are pinpointed on the four borders. Then we draw cross-connecting diagonals (as shown by solid lines). The point of intersection "X" denotes the index. The value of the index is determined by its distance from the radial center in the lower right-hand corner. This corner we consider to be 100 points. The upper left-hand corner is zero.

The dimensional proportion of the chart is not accidental. After some 15 tries we found the present 2-to-1 ratio the best.

Placement of the percentages is based on the nature of interrelationship. For example, "Unscheduled Overtime" is placed at left side because any changes in it should reflect the least effect on the index.

Turn the page

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MAINTENANCE OUTPUT

Begins on page 220

"Added Jobs" (on right) and "Activity Level" (at bottom) have a predominating influence. Note that we arrange all percentage values so that as the performance of any one decreases the index decreases.

We chose scale limits to fit our conditions. We felt a 0-12% range for "Unscheduled Overtime" and 0-25% range for "Added Jobs" would take care of all situations. We cut off "Activity" at 80% as a realistic and obtainable goal. But should it go over 80%, the index can be projected beyond 100 points.

Scale for the index was based on this formula: Length of each increment $= \frac{L}{20} + \frac{LN}{9}$ where L = base length of diagram and N = percentage of rating factor desired, expressed as a decimal. In other words, for each 10% increment in length you substitute 0.10, 0.20, 0.30, etc.

HOW WE APPLY THE INDEX

Let's take a hypothetical job (page 220) to see how we arrive at its index. Let's assume:

	Man-hours
Estimated time	800
Actual time	1000
Unscheduled overtime	50
Added jobs	100
Activity level	60%

Next step is to convert the man-hour factors to percentages:

Estimated time (%) = 800/1000 = 80%
Unscheduled overtime (%) = 50/1000 plus 100 = 4.5%
Added jobs (%) = 100/1000 plus 100 = 9%

Now we pinpoint these values on the chart, draw diagonals, and find the answer (81 points) at "X".

Suppose "Added Jobs" were 20% instead of 9%. Your index (dotted line) would be 72 points (at "Y"). Overestimating disrupts the work schedule, too. So for an overestimate of 10%, we use the 90% point on the man-hours scale, for 20% the 80% point, and so on.

HOW WE USE OUR INDEX

We interpret it two ways. First, to see how well we've planned and executed a job. Second, to see where we need improvement.

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Circle 587 on Reader Service Card

THERE MUST BE AN EASIER WAY

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JUST PUT A LITTLE MORE TAPE ON THESE... AND THEY'LL LAST FOR YEARS!!
I CAN'T DRAW ON THESE THINGS...THEY'RE ALL TAPE NOW!
I'VE HAD MY GLASSES CHANGED 4 TIMES AND I STILL CAN'T READ 'EM
THE ONLY THINGS THAT SHOW UP ON THE BLUEPRINTS ARE TAPEMARKS AND CREASES
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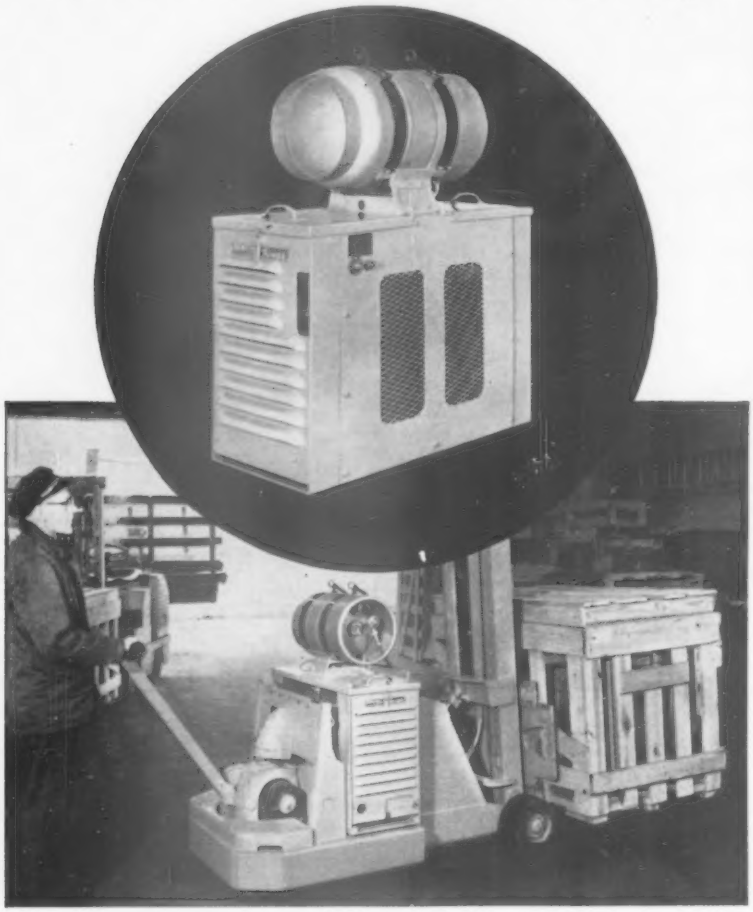

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Manufacturers of Gas and Diesel Engine-Driven Generators and Air Conditioning Units; Gas and Diesel-Electic Power Units for Industrial Trucks

Begins on page 220

job, a planner will gather the necessary data and plot the chart. It takes only a few minutes to plot. We also use the chart to plot a single index for a selected group of jobs, say for a certain area, or type of work, or calendar period. In such case the technique is simple. You add up the raw man-hour data of each job for each factor to get gross totals, and translate them to percentages in the same way as for a single job.

To derive the over-all activity level, however, you multiply the actual man-hours of each job by its activity percentage to get productive man-hours. Then you add these productive man-hours and divide by gross total of actual man-hours.

Because all charts, whether for single jobs or a group, provide an absolute point index, we can always compare the scores. We check major jobs against each other and against cumulative averages. These averages can be shown by the dark arrows along the borders of a chart and by a single point "Z" (see the chart). Higher management receives a chart for each major job and a monthly report including a combined chart for the month, and a cumulative index for the year to date.

Use of the charts for improvement is a natural consequence of their availability. The chart factors inherently reveal the reason for a poor index score. The bare-faced facts are there, easy to see, easy to interpret. We can now set goals, and check progress as each succeeding job comes through. For example, in the hypothetical case at hand we conclude 9% is too high for "Added Jobs." So we set a goal of 2½%, which, if it had been realized in this case, would have resulted in an index improvement of about 3 points. And so similar goals can be set simultaneously for other backward factors.

To improve any of these factors, the work must be properly planned and scheduled. Can this chart technique be applied where little or no planning and scheduling is practiced? Yes, it can. But if it's built on facts, you'll soon find out good planning and scheduling are necessary for a good score. **END**

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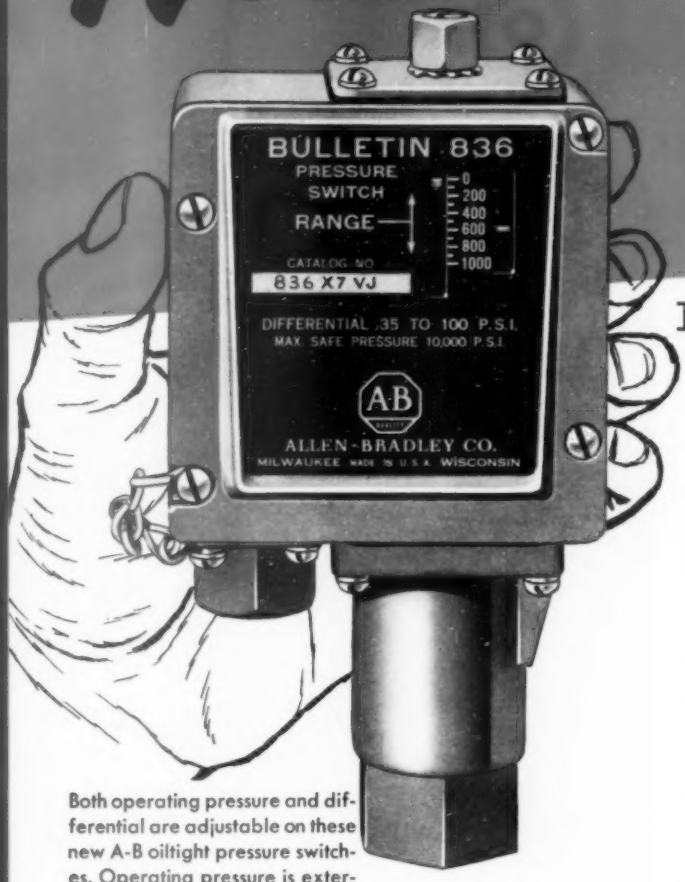
New ALLEN-BRADLEY OILTIGHT PRESSURE SWITCHES

Bulletin 836 Type T



Both operating pressure and differential are adjustable on these new A-B oiltight pressure switches. Operating pressure is externally adjustable, and setting shows on calibrated scale. A trip indicator shows operating point.

For machine tool hydraulic systems—operating at pressures up to 5,000 psi

Especially designed for heavy duty industrial applications, these new Allen-Bradley oiltight high pressure switches assure long, trouble free life. The attractive die-cast aluminum enclosure is completely sealed to exclude oil and water. The snap-action switch mechanism maintains its high contact pressure to the point of switchover—no matter how slowly it is approached. Contact chatter is eliminated—trouble free contact life is increased. The contact block has two isolated circuits with one N.O. and one N.C. set of contacts.

Send for complete information on this newest addition to Allen-Bradley's wide line of *quality* pilot controls.

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Internal view of piston design used on units for systems above 500 psi. Bellows type construction is used up to 500 psi.

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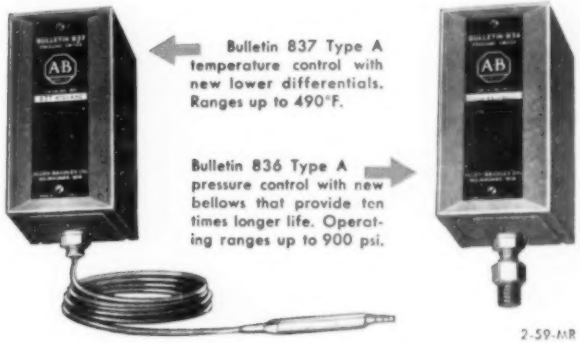

Bulletin 837 Type A temperature control with new lower differentials. Ranges up to 490°F.

Bulletin 836 Type A pressure control with new bellows that provide ten times longer life. Operating ranges up to 900 psi.

2-59-MR

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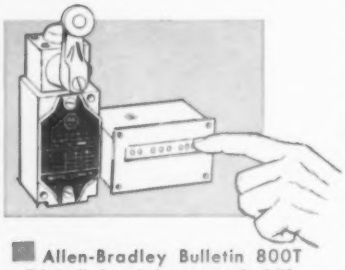

Allen-Bradley Bulletin 800T oiltight limit switches on typical life tests have run many millions of operations. Write for complete information on the Allen-Bradley line of quality limit switches for every industrial application.

Here are some new—and some old—Allen-Bradley oiltight limit switches—all built to give you extra millions of trouble free operations. Their switch bodies and operating heads are both sealed. Oil, dirt, and metal chips cannot enter and foul the contacts or cause sluggish operation of the momentary contact mechanism. Double break, silver alloy contacts never need maintenance. The snap action switch is positive insurance against any reduction of the contact pressure as the "trip point" is approached. This means less chance for chatter and arcing of relays, contactors, or starters operated by the limit switch—and prolonged trouble free contact life for the limit switch itself.

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Industry Moves Ahead with Plan '59...

To modernize now for growth and profits

The most expensive task to be performed in America, in this new year of 1959, is the modernization of our industrial plant and equipment. This is true despite the huge expenditures on new facilities made in the past decade.

Contrary to popular opinion, and even to much learned opinion, our industrial facilities are not up to date. In a special survey conducted in August 1958, and supplemented by further interviews since that time, the McGraw-Hill Department of Economics found that it would take $95 billion to bring all our plant and equipment up to the best modern standards. This is over $15 billion more than the record budget of the U.S. government for the coming year.

How did we get so far behind? It is true that business has made record capital expenditures in recent years, but most of this investment has been to expand capacity. And in concentrating on new capacity, industry has fallen behind on the modernization of older facilities. Meanwhile, the $8 billion a year surge of research and development has brought forth new machines and new processes, at a rate that makes prewar and even early postwar equipment badly obsolete.

The lag between what research has promised —especially in more efficient tools of production —and what has actually been accomplished up to now shows clearly in the AMERICAN MACHINIST inventory of metalworking equipment for 1958. This new study, covering 167 types of equipment in 5,800 metalworking plants, shows that three out of five metalworking machines are over ten years old. This is a startling indication of how obsolete many plants have become. A 1958 machine tool is 54% more productive than one purchased in 1948. Many of the tools industry now uses are actually of 1939, or earlier, design.

Investment Starts Up

Now industry's plans for 1959 show a new awareness of the need to modernize. In its surveys, conducted during the last part of 1958, the McGraw-Hill Department of Economics discovered these facts:

(1) Companies generally believe that a larger investment in modernization will

mean more profits—soon. Most of the manufacturing companies in the surveys expect their current modernization expenditures to pay off in less than five years. With labor costs rising steadily, it is only with better, more modern equipment that most companies can hope to make these profit gains.

(2) Industry's plans for modernization have been revised upward. Total plans for 1959 investment, in new plant and equipment, now come to $33 billion—compared with $31 billion reported earlier. And most of these new plans are directed toward modernization—installing new processes or making ready for new products, developed out of the most recent scientific advances.

It therefore seems clear that modernization expenditures in 1959 will rise enough to make an impressive start on the job of updating our plant and equipment. But it will be no more than a start. Research also is moving ahead with giant strides. Plant expenditures must increase rapidly, from 1958's low level, to win the battle against obsolescence.

How Can We Modernize Faster?

What can we do to accelerate industry's new drive for more modern plant and equipment? One aid will be an improved flow of technical information on how, and where, to modernize. With this purpose, the McGraw-Hill Publishing Company several months ago inaugurated PLAN '59, a joint effort by all its magazines to spotlight the best opportunities for modernization. During 1959, McGraw-Hill publications will continue this effort by putting special emphasis on new developments in plant and equipment.

On the key problem of financing modernization—the question "Where's the money coming from?"—the McGraw-Hill Department of Economics plans several new studies in the months ahead. The first of these will deal with the number one problem in financing: the need for adequate depreciation allowances. Such studies are a small, but we hope a helpful, part of the total effort that is needed to modernize American industry.

An Individual Effort

The really vital steps in modernizing must be taken by individual companies. The backlog of obsolete plant and equipment is widely dispersed, among firms of all sizes and in all areas. It cannot be wiped out by dynamic equipment policies on the part of a few leading firms. Not just a few, but thousands of industrial companies must take inventory of their respective equipment and compare it, case by case, with the best new machines available.

Finally, there is need for increased public recognition of the modernization problem, and for federal tax policies appropriate to a period of rapid technical change in business.

The most important point is that the modernization drive has begun. This start can accelerate, with intelligent business and public policies, to give us truly modern industrial facilities. Plant and equipment expenditures are finally beginning to reflect the stepped-up pace of research and development. This can be a major factor in renewed economic growth and prosperity as we move into 1959.

This message was prepared by the McGraw-Hill Department of Economics as part of our company-wide effort to report on opportunities for modernization in industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

Hall Industrial Water Report

VOLUME 7 FEBRUARY 1959 NUMBER 1

Let's Get This Clear

Day after day new products are being developed to improve the clarification of water. The standard coagulants, aluminum and iron sulfates, have long been supplemented with aids like clay and magnesium oxide. Some 20 years ago Baylis developed activated silica. But today new materials to assist clarification with the standard coagulants are coming along faster and faster. They are designed to improve removal of color, bacteria and suspended material from potable and industrial water, to cut costs by reducing coagulant consumption, to assist in removal of deleterious materials from waste water and to assure optimum operation of clarifiers and filters.

Hall Laboratories research and development continually provides improved coagulant aids, field tested for performance. Furthermore, Hall engineers know clarification equipment and processes. They are ready to help you improve clarification or reduce water treatment cost.

Feeding Ferric Sulfate

Ferric sulfate is a commonly used coagulant. When fed with a solution feeder, care must be taken to get the chemical completely into solution. Otherwise, undissolved material will cause trouble in the feeding equipment and effectiveness will be lost.

Each pound of ferric sulfate liberates about 260 BTU when it goes into solution. The resulting solution temperature increase has an important effect on rate of solution. If tap water temperature is too low, or if the ratio of water to ferric sulfate is too high, there will be troublesome undissolved material. Furthermore, final solution temperature should be 90°–100° F.

The practical trick for easy handling is careful adjustment of the water-to-chemical ratio. If water temperature is 68° F., dissolution of ferric sulfate will be complete in 18 minutes and final solution temperature will be about 98° F., if the ratio of water to solid ferric sulfate by weight is five. If water temperature is only 47° F., the solution rate and final temperature will remain the same, provided the ratio of water to chemical is cut to three. These examples may be used as a guide; obtain complete dissolving information from the manufacturer of the material used.

Water Color Problem

An Eastern woolen mill is located downstream from other woolen mills, a steel mill and a sewage plant. Needless to say, the river water is badly contaminated with organic coloring matter, suspended matter and detergents during summer droughts and extremely cold weather. Clarification has been difficult. Even with heavily increased alum dosages color removal was poor. This was a costly situation because it frequently necessitated reprocessing of the delicate pastel shades which are a specialty of this mill.

More than two years ago Hall Laboratories introduced the plant to coagulant aids. After laboratory jar tests were carried out to determine the type of aid best suited to this particular case, the plant adopted the use of a Hagan aid during periods of high color. Not only have floc formation, sedimentation and color removal been greatly improved, but alum dosage has been reduced by 25%. The plant operators say they feel sure they would have had to suspend operations during the 1957 drought if they had not been using the Hagan coagulant aid.

No Clarifier Needed

A growing Southern textile plant was forced to curtail operations because water requirements exceeded the total capacity of the wells. Further expansion was anticipated. The additional water required would have to come from a surface supply.

Faced with the installation of expensive clarification equipment and costly chemical treatment to make the water suitable for process work, the plant called on Hall Laboratories to study the problem. Hall engineer R. E. Elliott carried out the survey and came up with a money-saving answer. He found that a lot of water could be saved by re-using cooling water from closed heat exchangers, by repairing overflow mechanisms and by using untreated surface water for non-critical operations. No treatment of surface water would be necessary and enough good quality well water would be saved to permit *doubling* current operations.

Potential Trouble

When Hall engineer Peter Benes began service work at a Southern chemical plant he found a clay-like deposit accumulating in the sodium cycle units of the split-stream softeners. Because of previous bad experiences with aluminum in boiler water, Benes became alarmed when analysis showed the deposit to contain considerable aluminum.

Further analytical work traced the aluminum to the clarified and filtered makeup water. Clarification was accomplished with aluminum sulfate; but operation and pH value were such that there should have been very little aluminum in the filtered water. Benes kept digging. He found that soda ash, used to adjust upward the pH of the clarified water, was being added ahead of the filters. This resulted in dissolution of some of the small amount of suspended aluminum hydroxide floc passing to the filters.

Immediate change was made to feed the soda ash after the filters. Aluminum concentration of the filtered water dropped from 0.15 ppm to 0.05 ppm and the problem was solved.

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There are no "stock answers" to industrial water problems. For information on how the Hall System can help you solve your particular water problems, write, wire or call address below.

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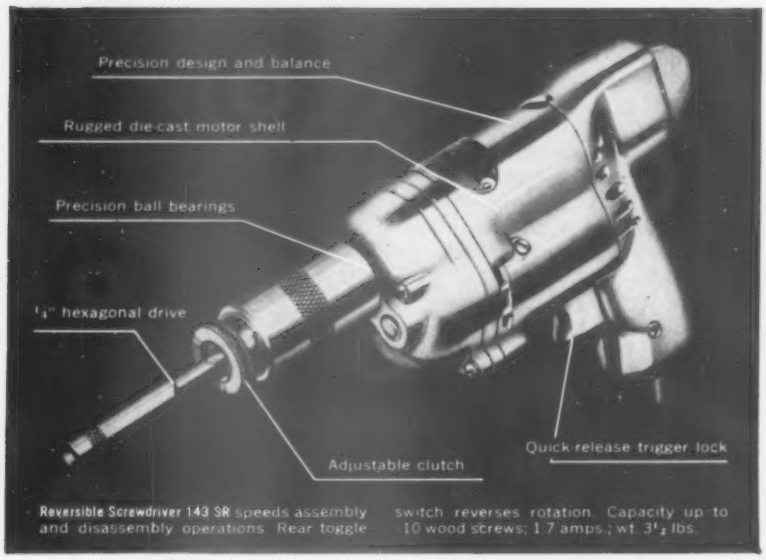

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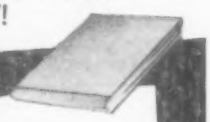
Do you need a good working formula for determining the minimum quantity of any item you order? (See Section 3, page 27.) Suppose two or more suppliers of the same commodity are also customers of your company, from whom do you buy? (See 7-20.) How can you reject an unsatisfactory shipment and still keep the goodwill of the vendor? (See 8-27.) These are typical of the questions answered here. Complete information ranges all the way from how to buy major construction (Section 15) to how to set up a "cash purchase order" system for the smallest orders (Section 9).

JUST OUT!



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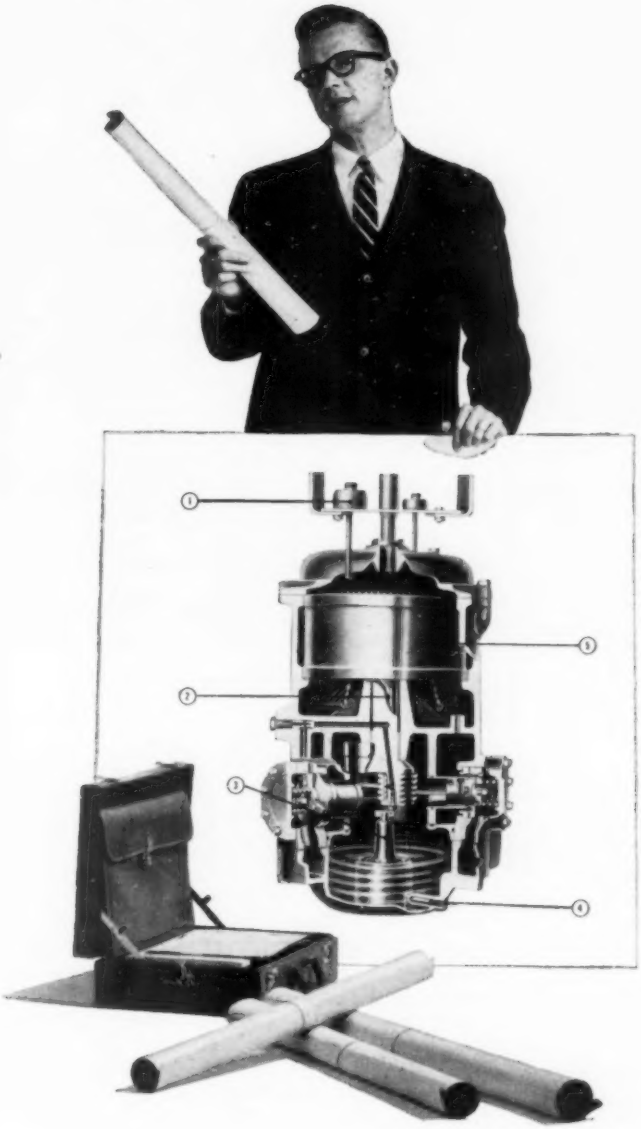

Here are 5 of the 18 reasons why it pays to pick Chrysler Liquid Chillers

Cooling for comfort? Or cooling a process? Only Chrysler Airtemp SW Liquid Chillers offer so many exclusive engineering advantages. Take the hermetically-sealed radial compressor, for example. You get:

① *Floating power.* Rubber-in-sheer suspension absorbs vibration. Noise is gone . . . and so are vibration-caused service headaches.

② *Direct drive.* No belts, no pulleys, no seals to break down. You get greater efficiency, less noise from a more compact package.

③ *Positive lubrication.* Exclusive pressure pump is sealed in a bath of oil. Moving parts get constant lubrication for long, trouble-free life.

④ *Crankcase heater.* Prevents refrigerant from condensing and diluting lubricant. Oil stays clean . . . and always ready to flow.

⑤ *Sealed-in motor.* Dust-proof for longer service life. Directly connected to dynamically balanced crankshaft to cut weight and operating costs.

The rest of the 18 reasons? They include innerfin direct expansion chiller, automatic control panel, easier installation and . . . But why not get the complete story from your local Chrysler Applied Machinery and Systems sales office. Or write: Airtemp Division, Chrysler Corporation, Dept. U-29, Dayton 1, Ohio.

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How Static Control Elements Do Five Logic Jobs

JOB (Logic Function)	NORMAL INPUT	OFF NORMAL INPUT	NEW WAY: STATIC CONTROL SYMBOL	CONVENTIONAL WAY – RELAY SYMBOL
AND	Go ahead when all signals come in. Push On Button	Don't proceed as before if any signal disappears. Push Off Button	A, B, C → AND	A B C; NORMALLY OPEN CONTACTS; OPERATING COIL (All contacts must be closed to energize operating coil.)
OR	Go ahead if any of several signals comes in. Push On Button	Don't proceed without at least one signal. Push Off Button	A, B, C → OR	A, B, C; NORMALLY OPEN CONTACTS; OPERATING COIL (Any closed contact energizes coil.)
NOT	Don't go ahead if any signal comes. Push Off Button	Go ahead if no signal comes. Push On Button	A → NOT	A; NORMALLY CLOSED CONTACT; OPERATING COIL (Energized relay opens circuit to coil; unenergized relay closes it.)
TIME DELAY	Go ahead after predetermined lapse of time. Push On Button Later	(No Output Without Input)	A → TD	A; TIME DELAY RELAY; OPERATING COIL (Contacts on energized relay close after time delay.)
MEMORY	ON. Go ahead as long as prescribed circuit conditions are unchanged. Hold On Button. OFF Sequence. Hold Off Button	(No Output Without Input)	A → ON, B → OFF	NORMALLY OPEN PUSHBUTTON; B; A; OPERATING COIL; NORMALLY CLOSED PUSHBUTTON; CONTACT ON OPERATING RELAY; (Contacts remain closed following initial closing of A. Open only on signal from B.)

For simple, versatile, reliable control of machines and processes . . .

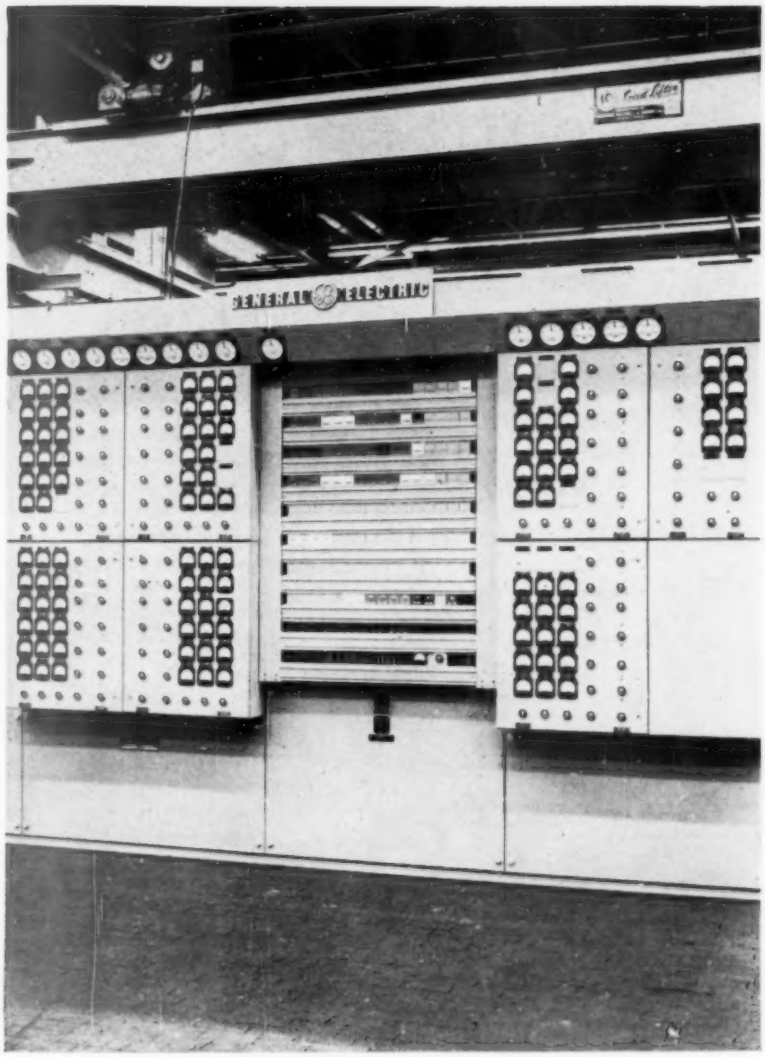
Coming Up Fast: Static Switching

These silent little switches will boost the reliability of your operations, speed up your controls, improve plant safety. Here's what you should know about them.

SIMPLE, SILENT, and sure. Those are the words that describe static switching. It's a control technique that's had a big send-off and now—today—is beginning to live up to its advance billing.

Throughout industry production men are hailing the little black boxes that put an end to relay troubles, bring automation a country mile closer. Control engineers, too, are welcoming static switches for their increased reliability, higher operating speeds, reduced maintenance over conventional relays. Maintenance engineers talk about no more trouble with controls. Says one: "I hope it stays that way because I don't like fixing something I can't see, hear, or adjust."

By EDWARD H. ABBE, Industry Control Department, General Electric Company, Roanoke, Va.



. . . static switching is the latest word.

A man would have to have superhuman senses to see or hear a static switch. Nothing moves, nothing hums. The switch just works. A static switching system will range from the size of a pack of cigarettes for a proximity limit switch to a panel as big as a room to program every step in a steel-mill operation. And it will make any electrical decision (chart above, left).

A static switching control is just another tool for accomplishing the same thing that any modern electric control system will do for you. It will accept signals from limit switches, pushbuttons, or any other pulse-type (on or off) electric source. The static switch transforms these signals (through the necessary sequencing, pre-set programs, and similar actions) into a positive action for a machine drive, process control, annunciator, and the like.

What's the story on this new type of control? Can you use static switching in your plant? Where should you look for opportunities? Will it pay off? How does it work?

First, let's get two things straight: . . . *Static switching isn't completely new.* The saturable reactor, granddaddy of all static control elements, has been used for several decades for theatre-light dimming and other control jobs.

. . . *Static switching really isn't switching.* When a static element is "off," output current is small, but not zero (as in a switch or relay).

WHERE TO USE IT

Static switching offers advantages over mechanical electrical control systems on three counts: It's more reliable, it's less troublesome to maintain, and it isn't fazed by a bad environment. Here are the conditions under which it works best:

Where reliability comes first—Static controls don't wear out. The number or frequency of operations has no measurable effect on their life. They can't be doctored by would-be or self-styled control designers in your maintenance department. They don't get out of adjustment, can't be improperly plugged into the circuit. And their over-all record for lasting reliability is nothing short of phenomenal. Such reliability counts high in operations such as programing batch mixing in food or pharmaceutical plants, controlling machine tools when increased safety is of high importance, or synchronizing automobile assembly lines.

Where maintenance is a problem—Keeping a complex bank of relays in good working order is not a job for a second-rate maintenance staff—or for a staff that's already too busy with other duties. There are many places (like warehouses or big-scale sorting or classifying areas) where only moderate maintenance skills are needed for the usual complement of equipment. But adding automatic classifying and transfer machinery, controlled by relays that need frequent maintenance, means you have to find maintenance skills that are rare and expensive. Static control elements are sealed, with no wearing parts. Their maintenance needs are limited to visual inspection and occasional cleaning off. If a component should fail because of some unpredictable circumstance, trouble-shooting is a simple step-by-step job done with indicating lights. A few spare elements are enough stock to put any control back in service in a few minutes. It's just a matter of plugging in a spare.

Turn the page

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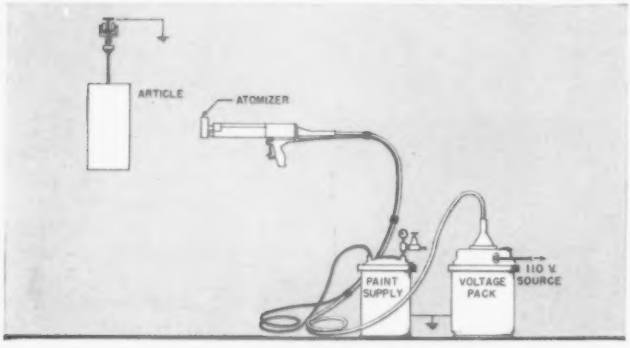

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Saves Labor, Increases Production because it is faster on many types of articles such as those fabricated from perforated and expanded metals, tubing, rod and wire. This is due to the "wrap-around" nature of electro-spray which paints ALL sides of such articles from one side only.

Saves in Equipment because no conventional spray booth is required—no water-wash, no sludge recovery! Uses no compressed air for atomization.

Saves Building Heat Loss because only mild ventilation for removal of solvent vapors is necessary, and . . .

Maintenance Costs Are Cut because clean-up and maintenance labor is only a fraction of that required by other, less efficient painting methods.

See how YOU can save in your own finishing department, and at the same time, improve the quality of the work. Write for literature and information showing how the Electrostatic Hand Gun has been proven on different products in a variety of industrial plants.

Call or write

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Electro-Coating Corp.
Box-23122, Indianapolis 23, Indiana

STATIC SWITCHING

Begins on page 232

Where environment is bad—Some of the most complex control jobs have to be done in atmospheres that are dusty, corrosive, damp, or electrically conductive, or that vary over a wide range of temperatures (steel mills, cement mills, or chemical plants, for example). Any of these surroundings will shorten the life and increase the maintenance of relay controls. But static switching components are encapsulated and sealed in plastic. Voltages and currents are so low that neither heat nor surface leakage creates a problem. Sub-zero or tropical temperatures have little or no effect on their efficient operation. Units operate in any position or under acceleration and shock that would cause most relays to bounce like a rubber ball.

HOW IT'S DIFFERENT

Every electric control system (or hydraulic, pneumatic, or any other medium, for that matter) can be broken down into three basic functions: information sensing, decision-making, and power output. The boundaries between the three groups are not always clearly defined, and in simple systems all three functions may be combined in one unit—a manually operated on-off lighting switch, for instance. Some components can be applied in more than one of the three functions, too. Most control systems, however, require components from all three groups.

Better than relays—Until about three years ago if you had to automatically turn on an electric motor on a machine tool conveyor drive after several other things happened first (and in the proper order), you had to use relays. They had to connect so that the circuit would be complete when all the right (and none of the wrong) relays were energized by their pilot limit switches, pushbuttons, float switches, and the like. Each new "if" you added to the circuit to make more decisions meant you had to add new relays. And the more automatic that production machinery became, the more built-in control "brains" had to be added to take into account every conceivable possibility of malfunction.

Turn the page

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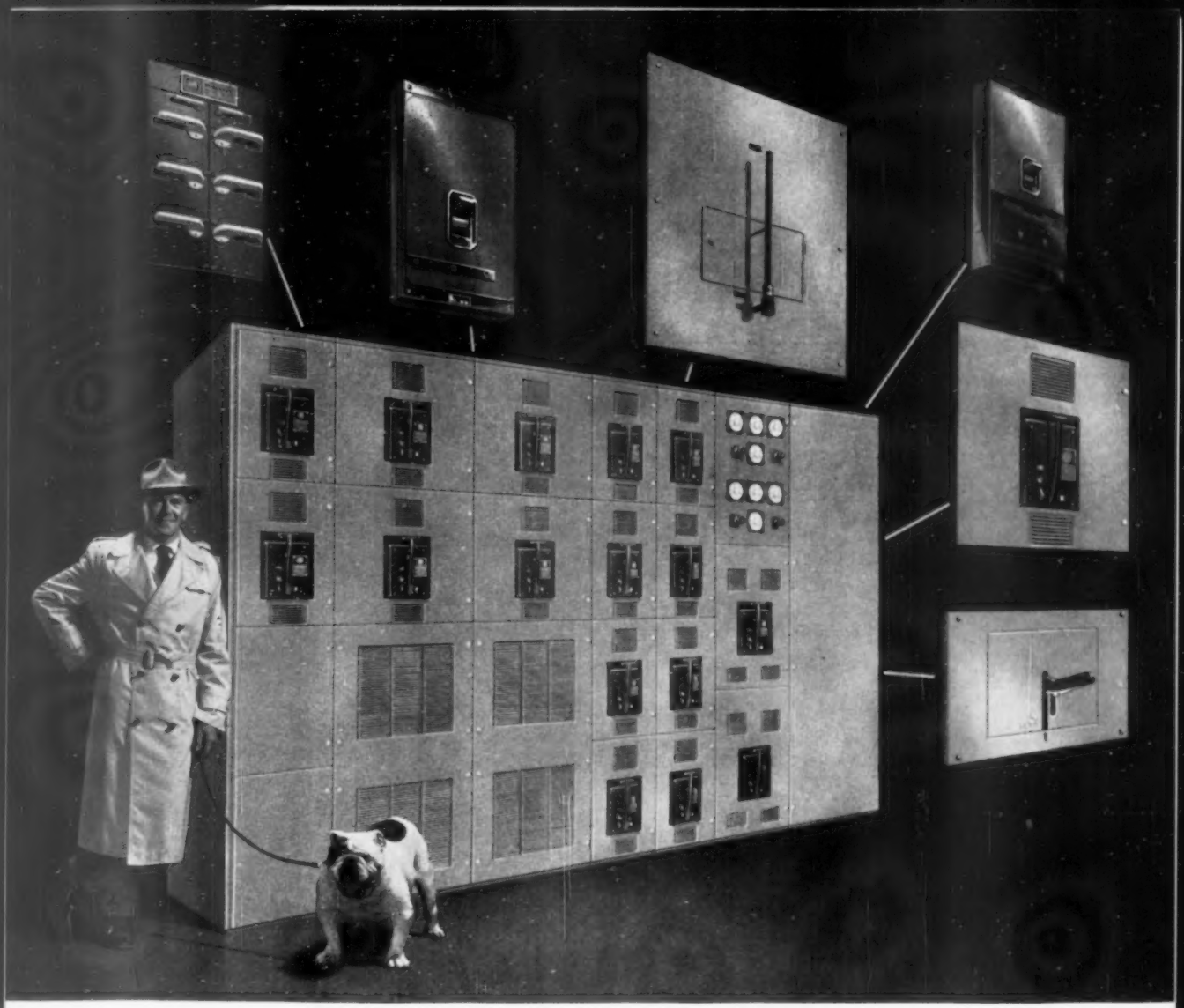

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BullDog's new Power Master lets you put everything from large air circuit breakers to small Vacu-Break® units in one space-saving enclosure. It will handle any of the following light-duty or heavy-duty switch units . . . in any combination:

- New K-line back-connected air circuit breakers, 225 to 4000 amperes
- Molded Case Circuit Breakers, back-connected or panelboard-mounted, 15 to 800 amperes
- Cordon* Circuit Breakers, back-connected, 15 to 600 amperes
- Fused Pressure Switches, back-connected, up to 4000 amperes
- BullDog DF-30 fused switches, back-connected, 30 to 1200 amperes
- BullDog Vacu-Break® units in panelboard mounting, 30 to 1200 amperes

In addition there is room for current-transformer equipment and metering systems.

A call will bring your local BullDog field engineer to assist you in selecting the type, combination and arrangement of units needed to handle your power load . . . help supervise installation. You'll find the new Power Master is easy and economical to install, too. Bus duct systems up to 4000 amperes can be connected directly to the board. For complete details send for Switchboard Bulletin SB-555. © BEPCO

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STATIC SWITCHING

Begins on page 232

Relays still have many distinct advantages. They're available from hundreds of different manufacturers, can be designed for almost every conceivable combination of ratings. Designers understand them. Maintenance personnel can see them, operate them, and interpret what's happening in the system. Standardization and a competitive market have brought prices to economical levels. But even with the high reliability and long life of modern relays, the law of averages catches up with you on big, new, complex control panels. As an example, where a high production rate puts a control panel with 100 relays through an operating cycle five times a minute, some relays will start to malfunction in a matter of weeks (even those with a built-in promise of several million trouble-free operations).

Better than tubes—Electronic tubes have been an available alternative to relays in the decision-making parts of control systems. But the tube has serious limitations. Tube deterioration, susceptibility to mechanical damage, and high over-all operating cost have been a few of the drawbacks.

Static control components, on the other hand, have none of these limitations. They do have their limitations, though. And these limitations need to be understood.

WHAT MAKES IT WORK

Static switching depends on some variation of the principle of the saturable reactor. The basic saturable reactor has two windings on a common iron core. The A-C winding presents an impedance to the flow of current in the circuit of the load in which it is connected. As a small amount of direct current is passed through the D-C control winding, the core becomes more and more saturated magnetically, thus reducing the impedance of the A-C winding. Eventually the core reaches full saturation and any further increase in control current has no effect.

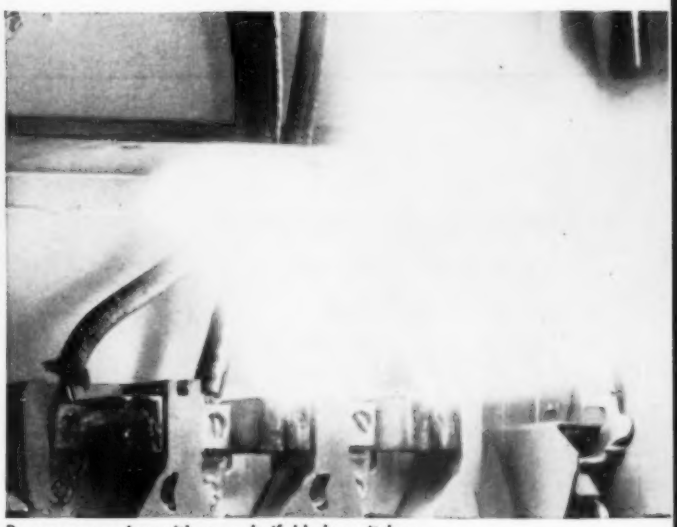
If the core of the reactor is made of one of the recently developed high-permeability alloys instead of iron, there's a sharply defined breaking point in the control current-out-

FOR SAFETY'S SAKE, BUY VACU-BREAK

With BullDog's exclusive clamped-pressure switching contacts

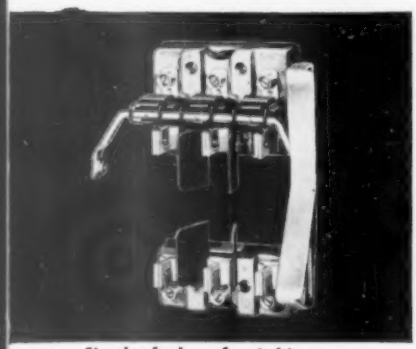
Maximum safety with BullDog Safety Switches

Arcs are smothered before they can cause fire hazard or damage to the switch because contacts are housed inside compact Vacu-Break* chambers. Pitting and burning of contacts are reduced to an absolute minimum—maintenance is virtually eliminated.



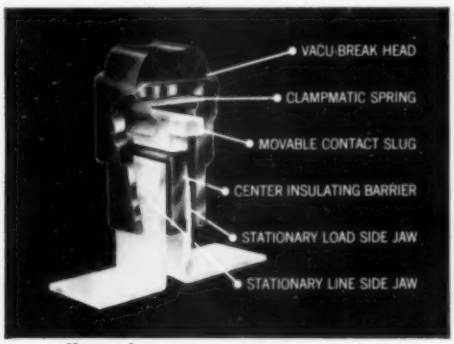
Dangerous arcing with open knifeblade switches

Unconfined flash explosion occurs, burning and pitting blades. Fire hazard and frequent maintenance are the result. These are unretouched photographs of 100 amp, 600 volt switches, operating under 90 ampere, 440 volt load with 40% to 50% power factor.



Simple, foolproof switching

Vacu-Break heads are *directly* connected to the switch handle. No toggles, triggers or springs to fail. No danger of switching failure. Positive, safe switching *every time* for a lifetime.



Clamped-pressure contacts

This close-up shows movable contact slug and Clampmatic* spring assembly inside Vacu-Break chamber. The Clampmatic assembly assures clamped-pressure contacts, speeds "break", increases switch life.

Withstand 100,000 amp fault current

BullDog Vacu-Break Switches—Master and Junior—will withstand 100,000 amp short circuit current when equipped with current-limiting Amp-Traps**. Play it safe—recommend and buy BullDog Vacu-Break!

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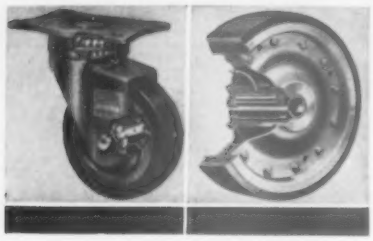
Help yourself to this helpful data

Free! Manual



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STATIC SWITCHING

Begins on page 232

put relationship. At one specific point a small change in the amount of D-C control current causes the output current to pass from near zero to maximum.

This switch-like effect is put to work to make a magnetic amplifier. Adjustable bias control windings, "on" and "off" input control windings, and A-C windings are combined on a common core. The windings can be designed so that with zero signal to the input winding the unit is "on" (output current flows), and so that one unit of minus or "off" signal will turn the unit off. (The core is thus bi-stable.) If one unit of voltage is then added to the "on" winding, the unit will return to "on." If two units of "off" signal are impressed, two units of "on" signal will be needed to turn the unit back on. This simple arrangement of achieving "output" or "no output"—depending on the algebraic sum of the inputs—is the unique advantage of magnetic amplifiers.

But designing a magnetic amplifier is only part of the job. Additional circuit elements are necessary to make individual magnetic amplifiers team up properly with other magnetic amplifiers to perform a complex control job. Static switching equipment manufacturers have added these necessary resistors, capacitors, and rectifiers to each amplifier and they have chosen circuit values so that the various types of devices are compatible with each other. Each encapsulated assembly is considered to be a static switching element.

As an example of static switching in practice, many of the popular elements contain resistors to limit input current, a feed-back resistor to allow a small part of the output to reinforce the "on" input signal so that the unit "snaps" into the "on" condition even more quickly when enough "on" signals are present. And it contains rectifiers to convert the controlled A-C into a D-C output that matches the input requirements of the following element or elements in the circuit.

Control by logic—The cartoon chart (page 232) shows the five basic functions of logic that cover almost every job any control system

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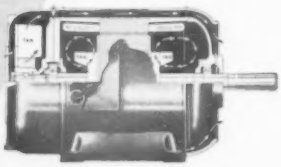

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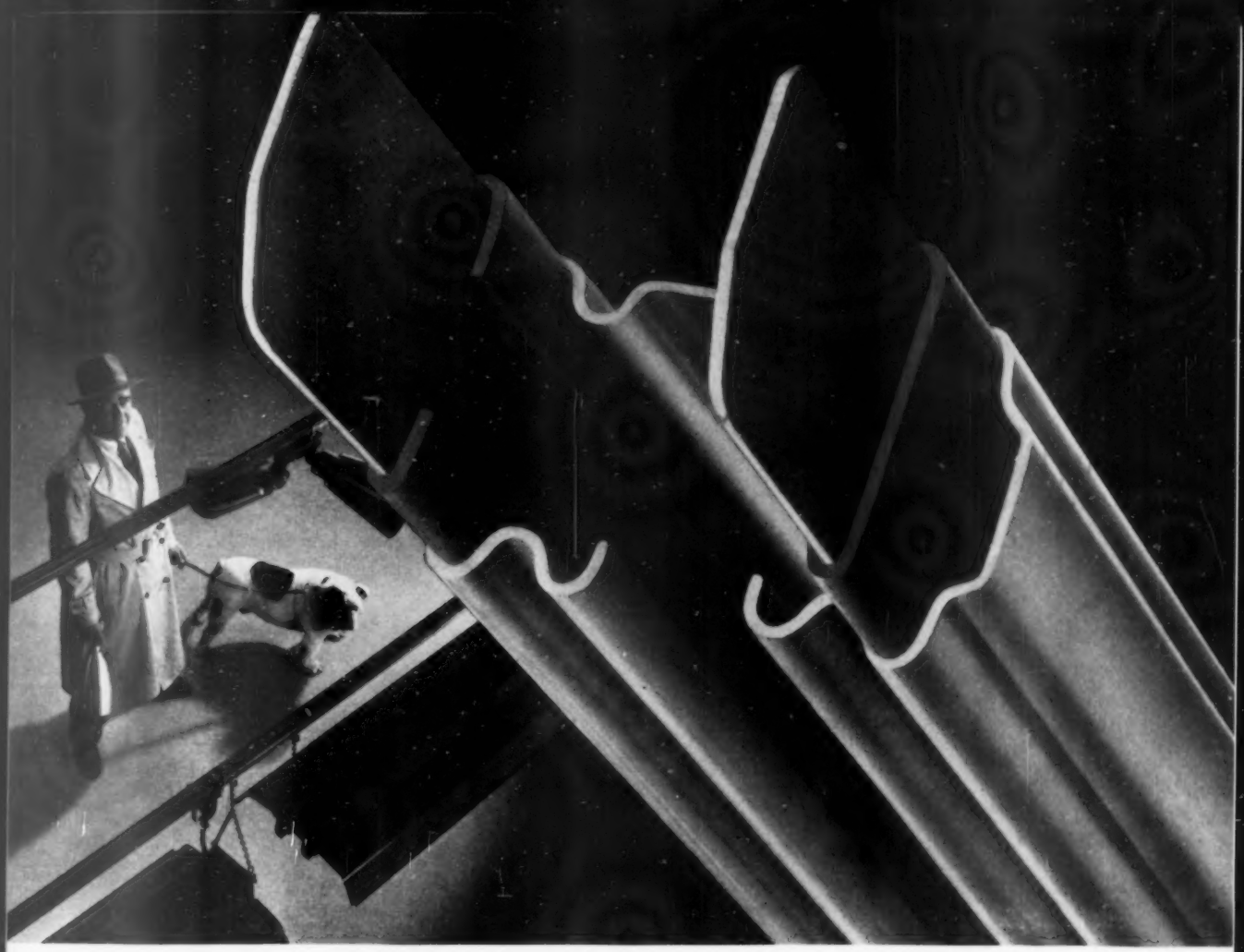

CHANGE LIGHTING FIXTURES AS OFTEN AS YOU WISH WITHOUT COSTLY REWIRING

Modern BullDog 20-amp Universal Lighting Duct permits fixture modernization at substantial savings over pipe and wire systems.

You know what an expense it is to install new lighting fixtures, especially when you're saddled with a pipe and wire electrical system. Extensive and *expensive* rewiring is just the beginning. There are fixture locations to plan, new hangers to install . . . and usually long production shutdowns. Waste is great, too, since old wiring can never be reused.

It's just the opposite with 20-amp Universal Lighting Duct. The system is exceptionally easy to install—both feeds and supports lighting fixtures. Twist-in plugs attached to each fixture let you tap into power in seconds. No costly rewiring. No production shutdowns. The entire system can even be relocated without loss if the need ever arises.

Further, since fixtures can be positioned at any spot along the duct, you can reposition them or add new ones whenever desired. In short, ULD will suit your lighting needs *exactly*, now and in the years to come.

When you modernize your lighting, modernize with BullDog Universal Lighting Duct. It is, *by far*, the most flexible and economical lighting system ever devised.

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BULLDOG

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can accomplish. The last column of the chart shows how conventional combinations of relays can be used to achieve the same effect. So the language of control-circuit logic really expresses what relay controls have been doing all the time. But with complex new control circuits, the control designer's job is easier if we express old concepts in simple new language.

The swift development of static switching systems has brought about many variations in the way individual logic functions are embodied in commercially available components. Some systems embody several different combinations of functions in each element, reduce the total number of elements, and simplify interconnections. For instance, you can buy a NOT, an OR, and an AND unit all internally connected in one sealed package. Some systems have built-in indicating lights to simplify routine maintenance. Some units combine magnetic amplifier switching with the control characteristics of transistors or diodes either in combinations or as separate elements.

There is no theoretical reason why individual magnetic amplifier units could not be built to control any desired amount of power or to operate at any frequency or voltage level. But it is cheaper to wind and assemble elements for low-voltage, low-current operations, handling milliwatts, and then amplify the final output signal or signals to a level high enough to drive a conventional contactor coil, solenoid, or whatever power output element is involved.

WHAT YOU'LL PAY FOR IT

Static elements cost from several dollars for some of the simpler units to ten times that amount for some of the combination units. Special power supplies are needed for most of the currently available systems, and amplifiers are needed for each separate output.

Both the amplifiers and the special power supplies needed in static systems are expensive. A standard power supply for one or two logic elements may cost just as much as one that will handle 25, so the ad-

Picture of worker saving money

He's helping cut maintenance 50% with Steiner roll towels

Here's why roll paper towels reduce washroom maintenance costs: Controlled roll paper towel dispensers hold more towels . . . in a cabinet of any given size you can get almost twice as many towels on a roll as you can folded. Also, Steiner control cuts towel waste . . . makes supply last longer. Means your roll towel cabinet has to be refilled only half as often as a folded towel cabinet. Saves as much as 50 percent in maintenance man-hours.

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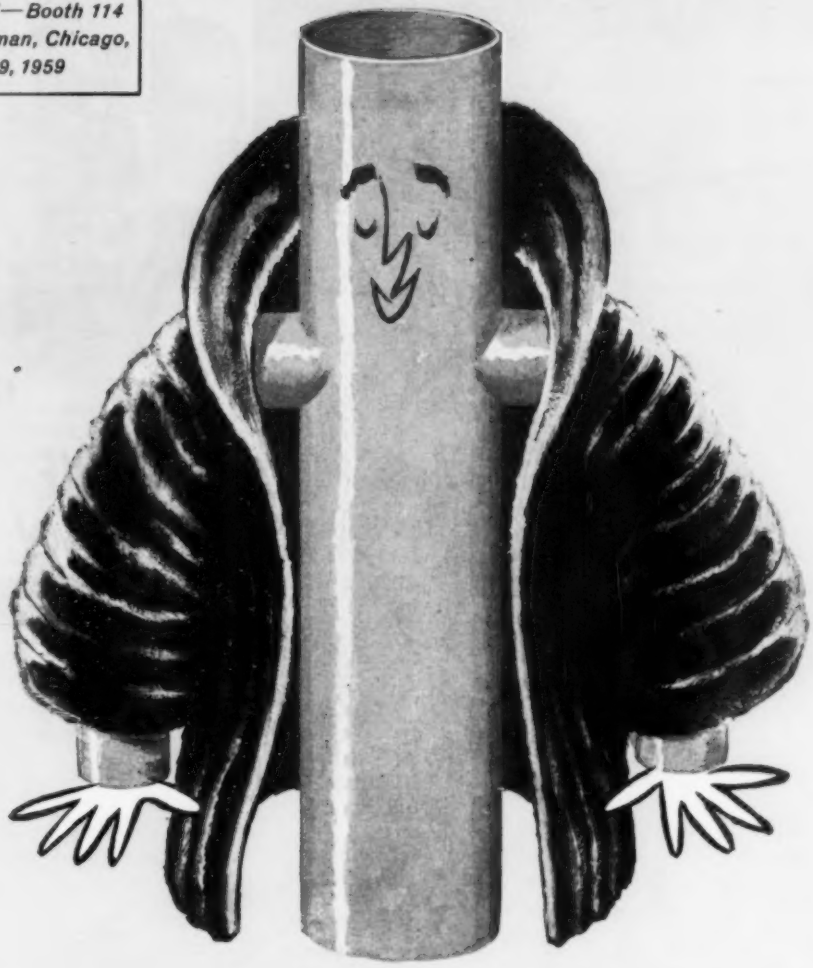

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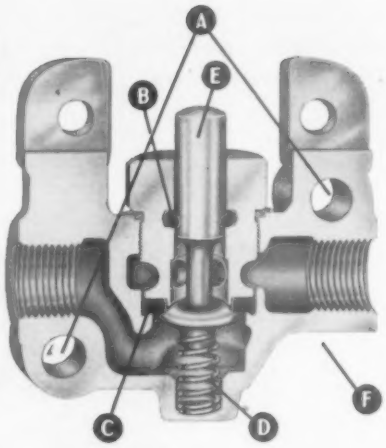
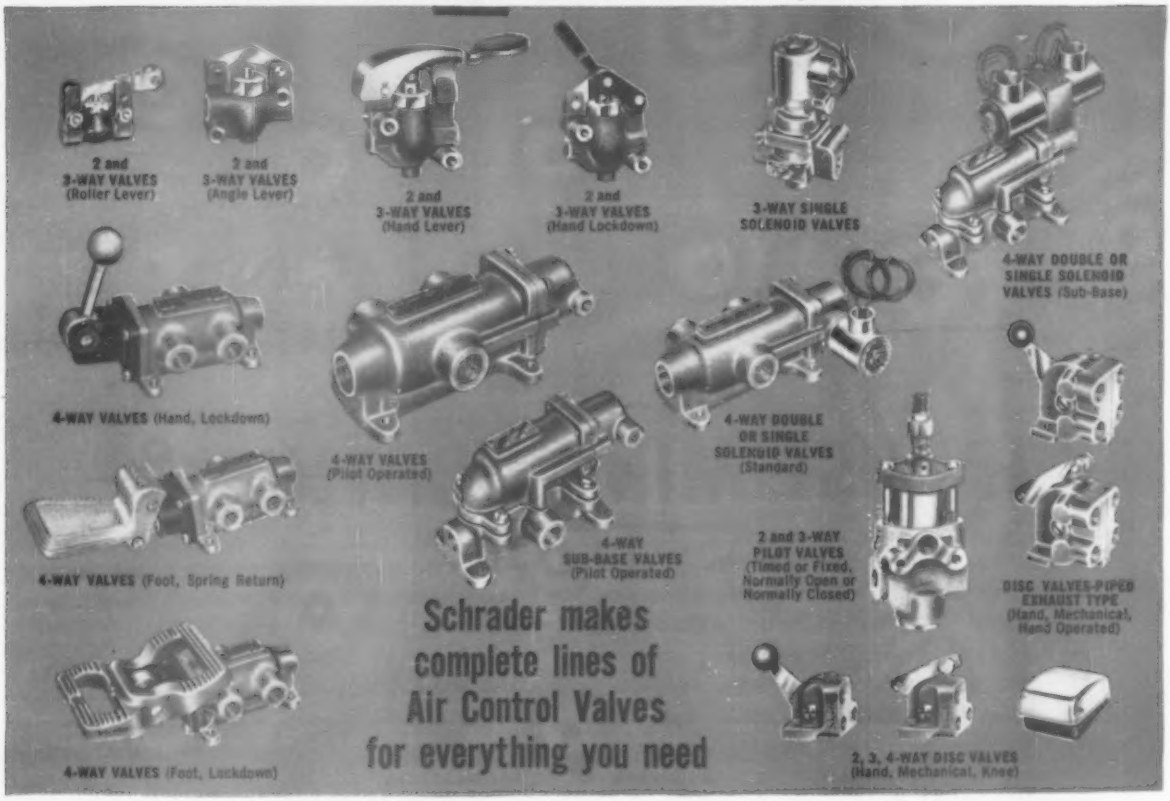
F—All parts designed for greatest air flow, longest life and simplicity of replacement and interchangeability.



INSIDE EVERY SCHRADER VALVE YOU CAN SEE SCHRADER QUALITY


2 and 3-WAY VALVES (Roller Lever)
2 and 3-WAY VALVES (Angle Lever)
2 and 3-WAY VALVES (Hand Lever)
2 and 3-WAY VALVES (Hand Lockdown)
3-WAY SINGLE SOLENOID VALVES
4-WAY DOUBLE OR SINGLE SOLENOID VALVES (Sub-Base)
4-WAY VALVES (Hand, Lockdown)
4-WAY VALVES (Pilot Operated)
4-WAY DOUBLE OR SINGLE SOLENOID VALVES (Standard)
4-WAY VALVES (Foot, Spring Return)
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DISC VALVES-PIPED EXHAUST TYPE (Hand, Mechanical, Hand Operated)
Schrader makes complete lines of Air Control Valves for everything you need
4-WAY VALVES (Foot, Lockdown)
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Plus hundreds of Air Cylinders and accessories for every need

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457 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

For more facts Circle 606 on Reader Service Card

vantages of a few-element static system have to be pretty strong to offset the added cost over a relay system (which doesn't normally require a special power supply).

There are wide variations in the cost ratios between static control and comparable relay systems. Usually the static control system has a higher initial cost. But as the decision-making portion of the system becomes more involved, or where a large number of information signals are used to operate a small number of power output devices, static control becomes cheaper.

A few general rules for applying static control can be laid down, however. If conventional contactors or other power elements must be used on the final stages of a control system, static control should be used when:

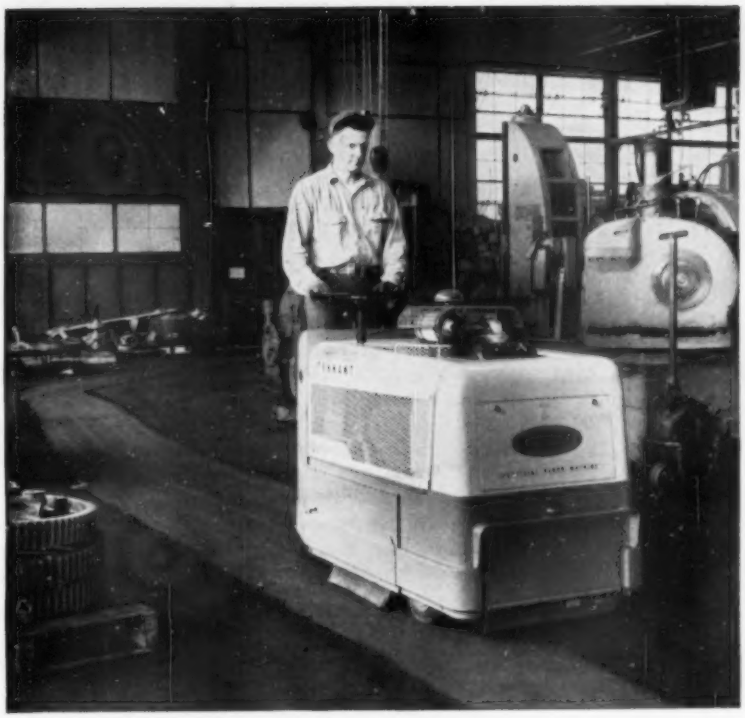
1. The decision-making or information-sensing elements operate far more often than the power elements.
2. Any improvement in reliability is of great value.
3. Environmental conditions in the plant are such that relays do not operate satisfactorily.

If the power output elements of a system can be made static, as in a visual annunciator panel or other non-moving device, the economic advantages of an all-static system become more pronounced, as mechanical maintenance problems are then completely eliminated.

HOW YOU CAN GET IT

At the present time there are only a few manufacturers of completely static standardized industrial control systems. Some components (like static proximity switches) are available from quite a number of sources. And the manufacture of static components for military control systems is spread over a great number of suppliers. For all practical purposes there is no compatibility between the components made by different suppliers, nor is it feasible to replace a single troublesome relay with a "package" static switching kit, although some work is being done in this direction.

Most static switching systems are being designed either by the electri-



1 man, on a TENNANT "L" Floor Machine . . .

removes 140 lbs. of grease-caked dirt in 22½ minutes

As he rides down this aisle on a TENNANT "L" Floor Machine, this man is doing a job you'd think was "impossible."

With no effort except to steer and use simple hydraulic controls, he's cleaning a 21" path . . . smoothly shaving off bumpy traffic-packed dirt at the rate of 140 lbs. in 22½ minutes.

That's a *ton* in less than 5½ hours!

CLEANS FLOOR IN 1 OPERATION

You see the results at the right. In one operation the machine's 1600 rpm cleaning cylinder *pulverizes* hard-packed dirt—then picks it up.

Provides a superbly clean floor at a rate 6 men couldn't equal by hand—a hard, dry, good-trucking surface that wheels can grip without wasted power or lost traction.

WRITE for illustrated bulletin, photos, performance data, traction-test results, etc. Smaller walk-behind machine available for congested areas.

BEFORE: Dirt build-up 1/16" to 1/8" thick wastes power, grabs wheels. Truck needs 28-lb. pull to keep moving.

AFTER: Cleaned by Tennant "L", floor is smooth and dry. Lets truck move with 9-lb. pull—1/3 the effort needed before.

G. H. TENNANT COMPANY
7058 N. Lilac Drive, Minneapolis 22, Minn.

TENNANT FLOOR MACHINES

SPECIALIZED MAINTENANCE EQUIPMENT

This Self-Contained Fluid Cooling System

. . . gives most accurate temperature control

Applied in cooling industrial machines or processes to temperatures approaching the ambient wet-bulb, the NIAGARA *Aero* HEAT EXCHANGER is independent of any more than a nominal water supply or disposal. The coolant system is a closed one, free from dirt and maintenance troubles.

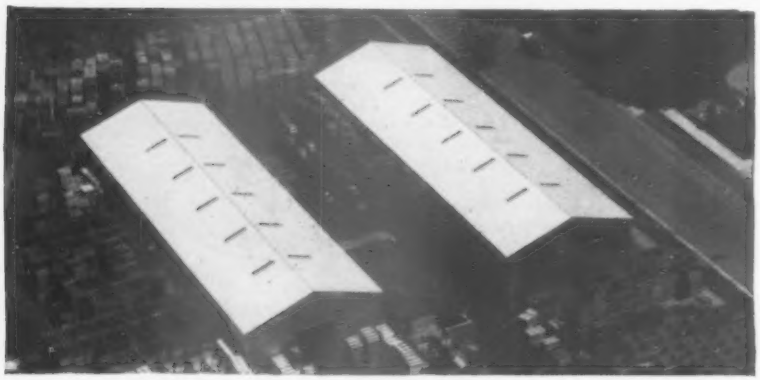
Heat is removed from your process *at the rate of input*, giving you precisely the temperature you require and assuring the quality of your product. Heat may be added to prevent freezing in winter or for better control in a warm-up period. Liquids or gases are cooled with equal effectiveness.

Heat is rejected outdoors. Only the little water evaporated on the cooling coils in the air stream, or discharged to prevent hardness build-up, is consumed.

Niagara sectional construction saves you much installation and upkeep expense, gives full access to all interior parts and piping. Your equipment always gives you full capacity and "new plant" efficiency.

Write for Niagara Bulletin No. 132 for complete information

NIAGARA BLOWER COMPANY
Dept. F-2, 405 Lexington Ave., New York 17, N. Y.
District Engineers in Principal Cities of U. S. and Canada
For more facts Circle 608 on Reader Service Card



MOTOR WHEEL CORPORATION SAVED 50% ON THESE POLE-TYPE INDUSTRIAL BUILDINGS

Both pictured general warehouses of the Motor Wheel Corporation have aluminum siding and roofing, skylights and asphalt floors.

Motor Wheel Corporation estimates these pole buildings were erected for half the cost of conventionally-built structures originally considered.

Regardless of the savings factor, Koppers pole buildings offer as many and more advantages than conventional structures. Pole Buildings are strong, sturdy, wind and weather resistant, and *permanent*, too! All poles and lumber in or near the ground are pressure-treated for protection against termites and decay. In addition, pole buildings go up quickly and easily; in weeks, not months.

You, too, can have the permanent, low cost, low maintenance building you need, fast with Koppers pole-type construction.

For complete information from one of our Qualified Contractors, mail the coupon today.

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C-18-A

Wood Preserving Division, Koppers Company, Inc.
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Please have one of your Qualified Contractors call.
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Company_____
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City_____ Zone___ State_____

244 For more facts Circle 609 on Reader Service Card FACTORY

cal designers attached to the staffs of machine tool or other production machinery manufacturers or by the static control equipment manufacturer's application engineers.

The engineering problems involved in applying static control to a machine tool or a sorting system are readily understood by any plant engineering personnel who now lay out relay-type control. Control manufacturers are publishing technical information, holding seminars, and giving training courses in an effort to spread necessary application information as widely as possible. But, the control designer in a plant using systems from more than one manufacturer would benefit from training on each system.

Maintenance people need new training, too. Although the job of trouble shooting is greatly simplified and seldom necessary with static equipment, maintenance staffs need training to know how to find the trouble and replace defective components in the minimum possible time. At present this specialized training is available only from control manufacturers or from production equipment manufacturers who use static switches.

BRIGHT FUTURE AHEAD

Three factors limit the wider application of static equipment today: high cost, limited capabilities, and resistance to change among the men responsible for specifying control systems. Component costs are high because quantities are still small and engineering time represents a big part of the manufacturers' total costs. High precision and quality control is necessary in component manufacture. Basic material costs are so moderate that when volume grows, the cost advantages now favoring relays will no longer exist. With the development of better core materials and production techniques and the use of magnetic static switching components (in combination with new and better solid state type static components such as transistors, diodes, and particularly the new controlled rectifier) we can expect far greater capabilities for static control in the future.

Longer Wear in every pair

and SAFER, too!

SEIBERLING

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INDUSTRIAL GLOVES

- Patented embossed NON-SLIP safety grip moulded into fingers and palm.
- Curved fingers for more comfort and better fit.
- *Tough and durable* . . . last longer, look better.

Natural Rubber or Neoprene Latex

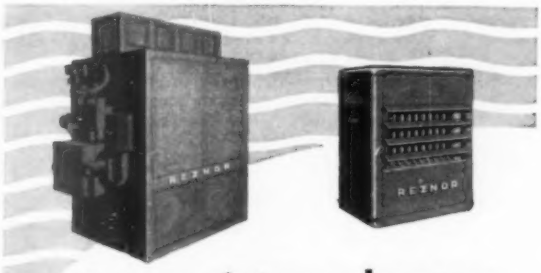
SEND FOR CATALOG No. G-11 of Seiberling's complete Industrial Glove Line!

Seiberling

LATEX PRODUCTS

New Bremen, Ohio

For more facts Circle 610 on Reader Service Card



stop moisture damage

Rust, mold and other types of moisture damage can be a real problem at both ends of your production line . . . destroying stockpiles of raw materials or attacking warehouse stocks of your finished product. Reznor gas unit heaters put a stop to such losses.

You can install Reznor gas unit heaters in your warehouse and storage buildings, set the thermostat and forget them. These completely automatic units, operating without any attention, will hold the temperature at any point you select. If rust or mold is a problem in your plant, ask your Reznor distributor for specific recommendations on how to stop it. For complete details on Reznor equipment for solving any plant heating problem, write for your free copy of "Modern Heating".

Look for Reznor under "Heaters-Unit" in the Yellow Pages

REZNOR

WORLD'S LARGEST-SELLING DIRECT-FIRED UNIT HEATERS

Reznor Manufacturing Company, 89 Union Street, Mercer, Pa.

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New (Model 734) Heavy Duty

CUSHMAN ELECTRIC TRUCKSTER®

Now you can carry up to a half-ton payload plus operator and passenger in a safe, silent, efficient Cushman Electric Truckster — gain extra convenience and economy.

Particularly suited for applications where gasoline powered equipment is not feasible, the three-wheeled Cushman Electric Truckster is easy to handle, easy to maneuver in cramped quarters.

Rigid unitized construction . . . heavy duty rear suspension . . . wedge type drive belts . . . a big 45⅝" by 61½" flat bed that can be equipped with stake racks . . . all add up to a rugged workhorse. Powered with heavy duty batteries, the 734 Electric Truckster travels up to 50 miles without recharging for a minimum operating cost. Fiber glass cab is available as optional equipment.

Ask your dealer for FREE demonstration or write for illustrated literature

Sold and serviced nationally — replacement parts immediately available. Dealer inquiries invited.

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"GRIDSTEEL" Pays for itself!

...You save two ways with
IRVICO "Gridsteel"

1. Initial low cost
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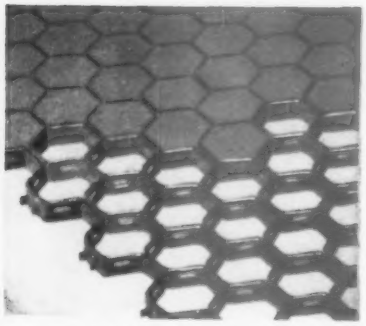

"Gridsteel" protects floors from the damage normally caused by impact, skidding, vibration and heavy traffic. "Gridsteel" is made of steel bars on edge, joined together in a honeycomb mesh pattern. No potholes or ruts can form because any crack in the fill cannot spread beyond a single steel mesh.

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will protect floors made of wood, concrete, or asphalt.

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ADVERTISERS' LITERATURE

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

MAINTENANCE

346—Hose, Cable Reels. Full information, sizes, capacities and applications. United Specialties, Inc.

347—Adhesive Finish. Descriptive bulletin describes use for dull, damp, damaged walls. Swift & Co.

348—Floor Care. 32-page booklet: "What Every Executive Should Know About This Vital .001." Masury-Young.

349—Rust Preventive. Complete literature with applications and color charts is available. Rust-Oleum Corp.

ELECTRICAL

350—Disk Brakes. Bulletins 2902M, 3002M, 3602M on electro-magnetic brakes. Stearns Electric Corp.

351—Switchboards. Bulletin SB-555 tells features of new power master switchboard. Bulldog Electric Products Co.

MATERIALS HANDLING

352—Shelving. Complete information on wedge-lock shelving for every storage need. Republic Steel Corp.

353—Materials Handling. Full details on steel boxes for saving space, time, money. Republic Steel Corp.

354—Pallet Trucks. Bulletin describes new model PXG LO-Lift walkie pallet truck. Barrett-Cravens Co.

355—Trolley Conveyors. Book No. 2330 describes features of system for streamlining operations. Link-Belt Co.

356—Conveyors. Bulletin No. 64 describes custom-planned conveyor systems with handidrives. Standard Conveyor Co.

357—Corrugated Boxes. Detailed literature available on new moisture-resistant boxes. Hinde & Dauch Co.

358—Truck Tires. Catalog MR-457 gives details and specifications on industrial solid tires. Monarch Rubber Co.

359—Locomotives. Literature describes and illustrates features, capacities, track gages, etc. Rogers Bros. Corp.

360—Hoppers, Self-Dumping. Full details upon request. Capacity: ½ to 2 cubic yards. Roura Iron Works, Inc.

361—Slings. Free handbook gives full data types, dimensions, weights and rated loads. Union Wire Rope Corp.

362—Electrical Hoist. Catalog lists mechanical features, capacities, and speeds. Chrisholm-Moore Hoist Div.

363—Wire Rope. Brochure gives complete information on new herringbone wire rope. John A. Roebling's Sons Co.

364—Casters and Wheels. Free manual contains helpful data on selection of maker's line. Darnell Corp.

365—Screw Conveyors. Folder 2489 gives complete facts and details of mechanical construction. Link-Belt Co.

366—Cranes. Bulletin covers detailed mechanical features for assured dependable performance. Abell-Howe Co.

367—Storage Racks. Catalog describes mechanical features of adjustable racks. American Metal Products Co.

368—Electric Truckster. Illustrated literature gives complete data and applications. Cushman Motors.

369—Trucks. "Gas vs Electric Trucks," "LP-Gas vs Electric Trucks," and catalog. Elwell-Parker Electric Co.

370—Lift Trucks. Booklet SP-23 describes new Pace-maker fork lift truck for varied applications. Towmotor Corp.

371—Lift Trucks. Specification sheet showing complete details available on request. Clark Equipment Co.

PRODUCTION

372—Air Filters. Bulletin 117 explains line of air equipment for compressed air problems. R. P. Adams Co.

373—Data Processing. Illustrated Brochure F-2 gives full information on the system. Royal McBee Corp.

374—Clutches, Couplings. Catalog No. 141 gives complete details on automatic centrifugal types. Formsprag Co.

375—Fastening Tools. New Catalog 30-D lists several special fastening tools. Apex Machine & Tool Co.

376—Filters, Separators. Technical literature, engineering assistance available. Commercial Filters Corp.

377—Vibratory Feeder. Fact File describes features of new electro-permanent magnetic type. Eriez Mfg. Co.

378—Schedule Board. Bulletin X-300 shows applications of visual control board. Graphic Systems, Inc.

Turn the page

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Forming and handling polished metal sheet can be speeded . . . rejects almost eliminated . . . by using "SCOTCH" Brand Masking Paper and tight-holding "SCOTCH" Brand Masking Tape. Applied prior to forming operations, such protective masks guard polished surfaces against scratches, die marks, staining—may be left on right through shipping if desired, yet removes easily and cleanly. Application can be kept up to production line speed by using "SCOTCH" Brand Apron Tapers to apply the tape to one or both edges of the paper as it is pulled from the roll. Fast, easy, economical . . . the cost-saving way to increase handling speeds on flat, polished metal stock.

Looking for Cost Saving Short Cuts? No matter what your metal-working operations include, chances are "TAPEnology" can help you do it faster, better, at less cost. Ask your nearest "SCOTCH" Brand Tape Distributor for complete information, or write: 3M Co., St. Paul 6, Minn., Dept. CO-29.

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. . . WHERE RESEARCH IS THE KEY TO TOMORROW

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Has The Answer

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Whether you need steel, bronze or stainless-steel to convey air, oil, water, gas, steam, volatiles or light solids, Penflex has the answer. Its complete line of corrugated and interlocked tubing is rugged, safe at high pressures and temperatures. Write for complete data to Pennsylvania Flexible Metallic Tubing Co., Inc., 7241 Powers Lane, Philadelphia 42, Pa.

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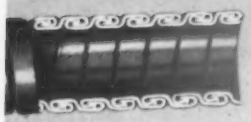
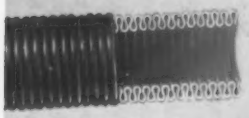
Write for your copy.



Penflex Interlocked Hose



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PENFLEX
TIGHT AS A PIPE BUT...
FLEXIBLE

ADVERTISERS' LITERATURE

Begins on page 246

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

379—Cylinders. Bulletin SQ 10-58 lists design range of air and hydraulic cylinders. Tomkins-Johnson Co.

380—Industrial TV. Illustrated brochure covers industrial TV equipment and systems. Philco Corp.

381—Plate Magnets. Six-page, fact-filled folder describes new permanent plate magnets. Eriez Mfg. Co.

382—Spray Painting Masks. Free literature gives mechanical details and applications. Conforming Matrix Corp.

383—Visual Control Panels. Information on visual control panels and equipment. Acme Visible Records, Inc.

384—Pumps. Bulletin 955-S gives complete details and features of double-suction pumps. Buffalo Forge Co.

385—Staplers. Free bulletins tell how stapling cuts costs in varied applications. Bostitch, Inc.

386—Chain Drives. Bulletin 2425 (88 pages) describes and lists varied applications. Link-Belt Co.

387—Inspection Penetrant. Bulletin describes new formula dye penetrant for surface inspections. Magnaflux Corp.

388—Fasteners. Full information on new machine, carriage bolts produced to quality standards. Standard Screw Co.

389—Heat Exchanger. Bulletin 132 gives data on self-contained fluid cooling system. Niagara Blower Co.

390—Heat Transfers. Bulletin P60 gives complete data on new multi-zone unit. Tranter Manufacturing, Inc.

BUILDINGS

391—Budget Buildings. Available in 32- to 48-ft. widths, 12- and 14-ft. heights. Republic Steel Corp.

392—Industrial Sites. 112-page book: "Minnesota Welcomes New Industry." State of Minnesota.

PLANT SERVICES

393—Metal Lumber. Slotted angle for storage racks, catwalks, supports, guard rails. Republic Steel Corp.

394—Grating. 20-page catalog gives complete information on "Gridsteel" floor armor. Irving Subway Grating Co.

Turn the page

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You name the job or jobs to be done! We'll supply a crane or cranes that will do it. Standard Models in a wide range of styles, sizes and capacities will generally meet your requirements. If not, we'll engineer and build what you need. We've been doing it for more than 40 years.

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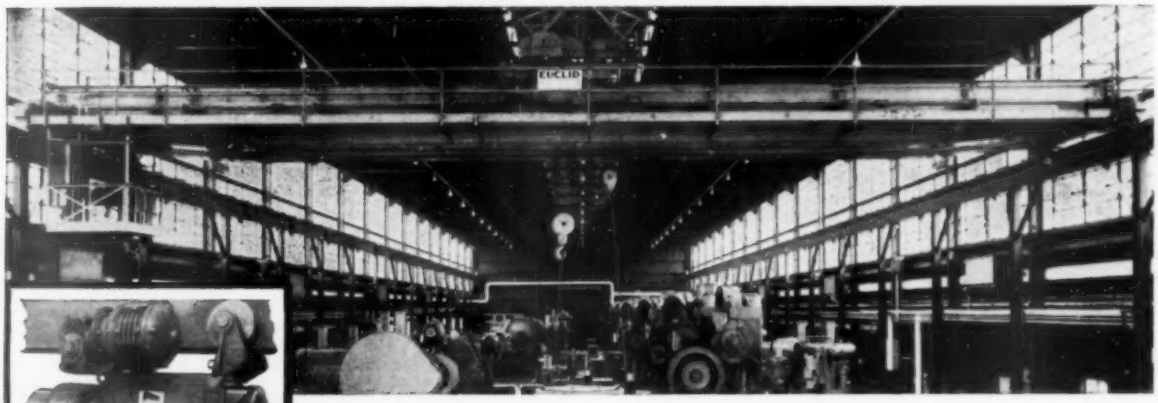

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The planetary gearing and mechanical load brake are mounted in oil tight housings. The hoist gearing is assembled in the hoist drum.

This design produces an unusual compact, rugged and accessible hoist readily adapted to various installations and types of control.

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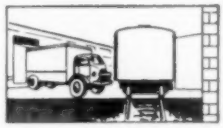
DAZZO Dock Shelters adjust themselves automatically to different dimensions of railroad cars or trucks. They expand in seconds by gravity, without use of springs. They retract out of the way when not in use.



Save *money* and *grief* . . . write for the facts about DAZZO Dock Shelters today!

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NEW Max. Torque Ranges — 1½ to 75 lb ft — 17 Sizes

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Field-Proved Reliability

Floor, or NEMA "C" Motor Flange Mountings

Exclusive "Visi-Indicator"

*E — dusts, including aluminum, magnesium, and their alloys
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Top efficiency...Competitive costs from

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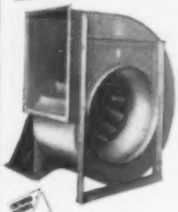
NEW **INDUSTRIAL FANS**



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- AIR
- MATERIAL HANDLING

A type and design to serve any industrial application.

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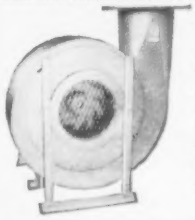
General TURBO-PRESSURE BLOWERS

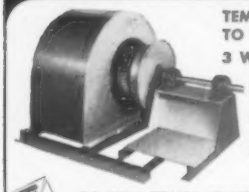
4 Oz. to 3 Lbs. PRESSURE 80 C.F.M. to 10,000 C.F.M.



Cost less to operate . . . Deliver higher C.F.M. for a given H.P. with higher maximum efficiency. Available with corrosion-resistant coatings or stainless alloys.

WRITE FOR BULLETIN TB-109

General "DURA-TEMP" HEAT FANS



TEMPERATURES TO 1650° F
3 WHEEL TYPES
- FORWARD CURVE
- BACKWARD BLADE
- RADIAL ROTARY

GENERAL "DURA-TEMP" Heat Fans have acceptance by major kiln and industrial furnace manufacturers.
WRITE FOR BULLETIN HF-100

General
BACKWARD BLADE, NON-OVERLOADING CENTRIFUGAL FANS
688 C.F.M. to 122,560 C.F.M., ⅛" to 12" S.P.
WRITE FOR BULLETIN BB-105

General Blower Company

"Leaders for Industry"

DEPT. C • MORTON GROVE, ILLINOIS

ADVERTISERS' LITERATURE

Begins on page 246

Offered in ads received up to 5th of last month. To get items you want, circle numbers on Reader Service Card next to back cover.

395—Dust Collectors. Illustrated folder lists over 38 models, plus accessories and fittings. Aget Mfg. Co.

396—Industrial Gloves. Catalog G-11 covers complete line of natural rubber or Neoprene latex. Seiberling Latex.

397—Padlocks. This free catalog describes full line for every industrial use. Master Lock Co.

398—Steel Shop Equipment. Catalog 100 (84 pages) illustrates diversified line. Lyon Metal Products, Inc.

399—Unit Heaters. Free copy of "Modern Heating" tells how to solve plant heating problems. Reznor Mfg. Co.

400—Dust Collectors. Bulletin 922 gives you complete data on ventrijet wet dust collector. Pangborn Corp.

401—Washroom Service. Free booklet contains tested and proved principles for guidance. Scott Paper Co.

402—Ventilating Units. Bulletin 3720-A gives data. Capacities from 500 to 20,000 cfm. Buffalo Forge Co.

403—Steel Shop Equipment. Catalog lists maker's line with mechanical features. Borroughs Mfg. Co.

404—Gate Valves. Illustrated descriptive folder gives full information on this line. Fairbanks Co.

405—Rust, Corrosion Preventive. Latest bulletin describes properties for varied applications. Sudbury Laboratory.

MISCELLANEOUS

406—Fire-Resistant Paints. Four-page pamphlet, "Paint On Fire Protection," upon request. Alim Corp.

407—Reproduction Materials. Booklet 17-2 has full information, shows all the short cuts. Eastman Kodak Co.

408—Silicone Based Paints. New brochure gives facts on paints formulated with silicones. Dow Corning Corp.

Your 1958 Index

Over 800 entries list articles and Case Book items, index companies and authors. For free copy, write to FACTORY's Reader Service Dept., 330 W. 42nd St., New York 36.

Intricate Shapes

BY THE THOUSANDS

There's no limit to the number of intricate shapes quickly and easily turned-out on

THOMSON DIE CUTTING and CREASING PRESSES

for Cloth, Plastic, Leather, Rubber, Composition, Cork, Linoleum, Wood, Thin Metals, Fibre, Cardboard, Hardboard, Masonite and many other sheet stocks.

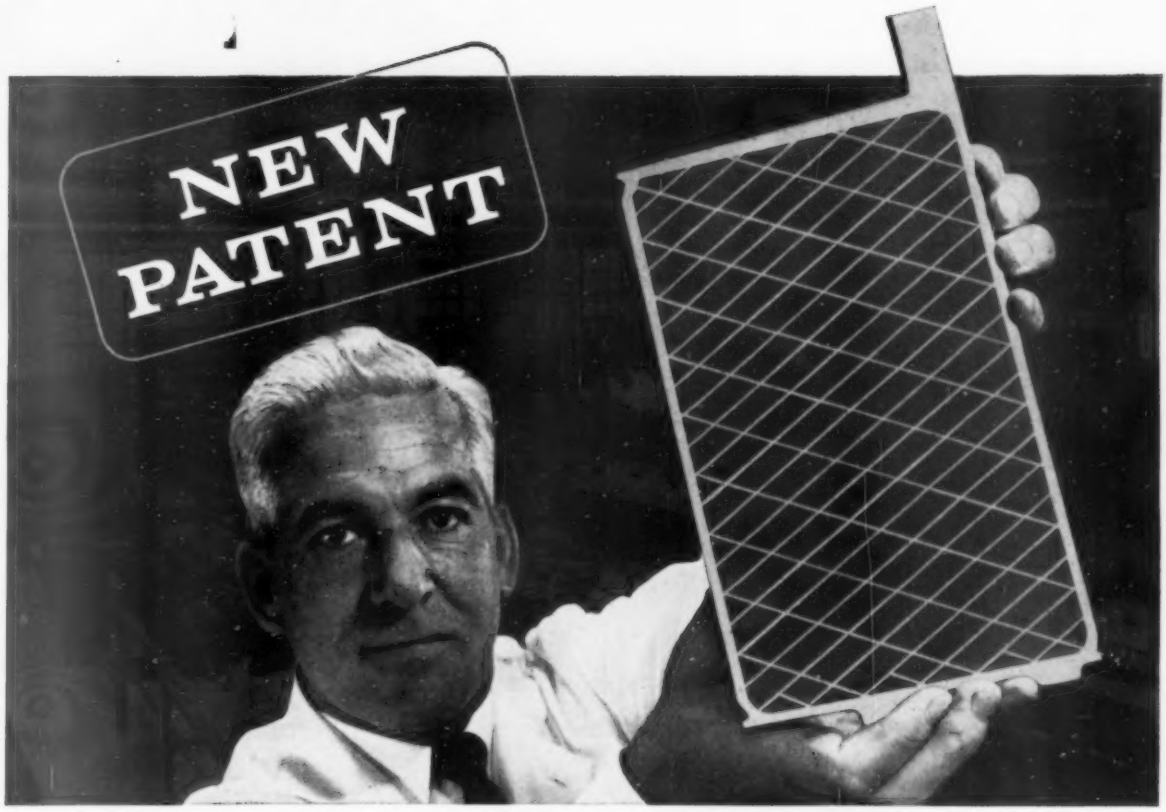
Cutting and Creasing Presses can — in one operation — cut holes, slots, serrations, irregular shapes, perforations, knock-outs and segments. Steel rule cutting knives can be formed to any shape thereby eliminating expensive dies. And embossed printed circuitry, book covers, etc.

Up to 2000 impressions per hour can be turned-out with a Thomson Cutting and Creasing Press. Change multiple operations into a complete, one-step method of fast, accurate production.

Cutting and Creasing Presses are already used in the manufacture of toys, games and puzzles, floor tiles, gaskets, panels, chassis parts, sub-assemblies advertising displays, insulations, gussets and stiffeners, etc.

INVESTIGATE THE APPLICATION OF A THOMSON CUTTING and CREASING PRESS TO YOUR PRODUCTION LINE

THOMSON-NATIONAL PRESS COMPANY, INC.
Franklin, Mass., Tel. Franklin 200



The New *gould* SILCONIC Plate Lengthens Battery Life 10-25%

Two distinct improvements:

1. Gould has developed a new patented (July 1958) process for introducing Silver-Cobalt into the active materials of the positive plates of Motive Power Batteries.

The temporarily soluble silver-cobalt sulphates, when added to the active materials, migrate to all positive grid members.

The Sulphates collect on the grid members to form an insoluble oxide surface or protective sheath which is impervious to acid and oxygen attack.

2. In order to insure a homogeneous grid completely free of flaws, a carefully determined amount of arsenic is added to the regular metal. This produces a smooth flowing metal during the casting operation which results in an extremely dense and uniform grid.

By selectively adding the silver-cobalt and arsenic to the plate, Gould is able to produce the new *SILCONIC* positive plate . . . a Gould exclusive.

Gould Industrial Truck Batteries with Silconic Plates resist corrosion, hold their charge and last longer.

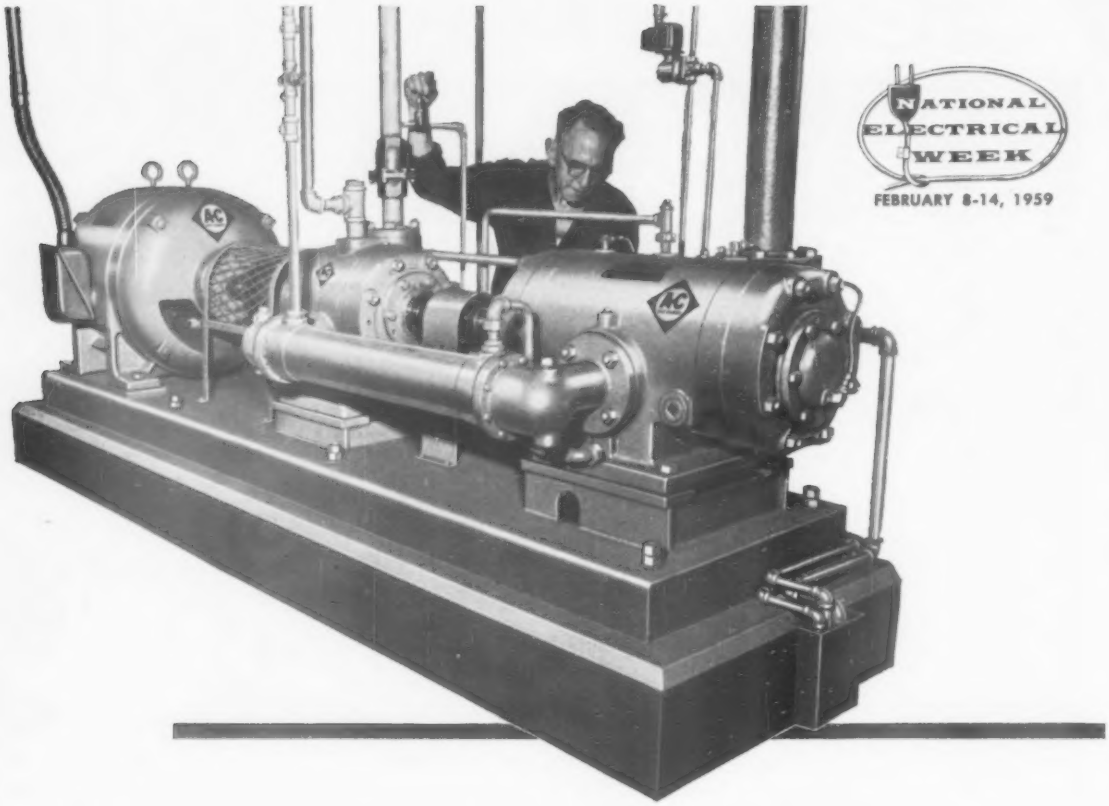
HOLDS CHARGE LONGER. In those applications where batteries are idle for periods of time the *SILCONIC* Plate is ideal. This Silver-Cobalt coating prevents migration of materials to the negative plate, effectively reducing self discharge within the cell.

MIGRATION OF SILVER-COBALT ATOMS. The migration of Silver-Cobalt atoms continues throughout battery life, offering continuous resistance to the corrosive attack of acid and oxygen. This continuous effect is the result of a solid state migration of the Silver-Cobalt which penetrates deeper and deeper into the grid metal during battery operation, thus prolonging the life of the *SILCONIC* Plate.

LONG-FULL SHIFT OPERATION ASSURED. Comparative tests between *SILCONIC* and conventional plates prove that the *SILCONIC* Plate maintains maximum capacity for a considerably greater portion of its service life, retards the tendency toward grid growth, assures longer full shift operation of batteries.

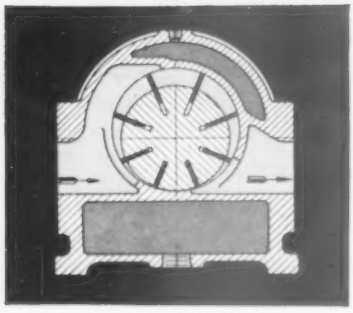
Write for complete data or call your local Gould representative. He's listed under "Batteries Industrial" in the yellow pages. Gould-National Batteries, Inc., Trenton 7, N. J.

More Power to you from Gould

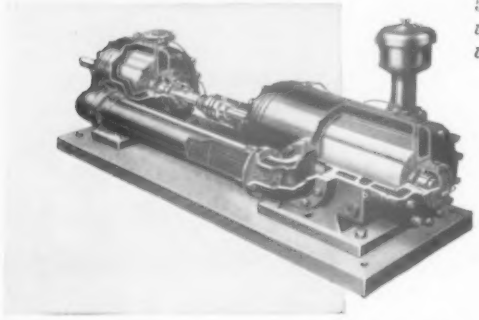


NATIONAL ELECTRICAL WEEK
FEBRUARY 8-14, 1959

Smooth operation—Prolonged efficiency



Simple operation—centrifugal force holds blades against sidewall to form air chamber.



with Ro-Flo compressors for plant air supply

Rotary operation is smooth, vibrationless. Compare this to the pounding and shock inherent in reciprocating compressors.

That's why *Ro-Flo* compressors eliminate the cost of heavy foundations. A slab is enough. Smaller units are bolted to the floor. And "like-new" efficiency is maintained for years — because rotor blades compensate for wear automatically.

No pistons, valves or connecting rods to cause trouble. Only two wearing parts in the *Ro-Flo* compressor. All this means far less maintenance.

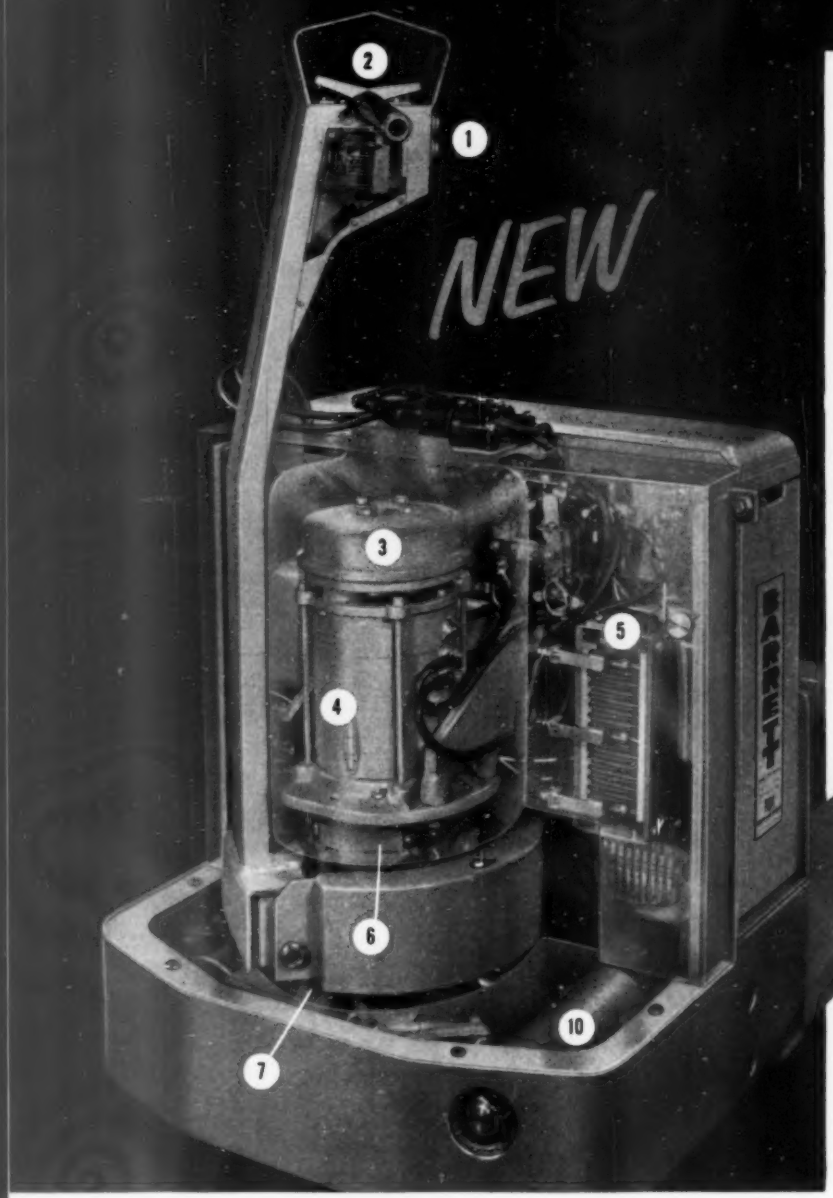
Two-stage units range from 250 to 1800 cfm, from 60 to 125 lb gauge. Single-stage units from 40 to 3000 cfm, up to 50 lb gauge. *Ask your A-C man for descriptive literature, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.*

Ro-Flo is an Allis-Chalmers trademark.

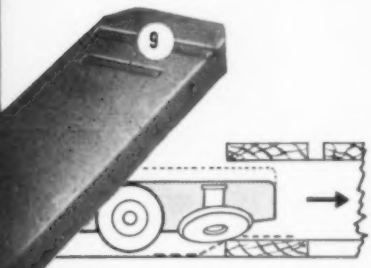
ALLIS-CHALMERS A-C

A-5899

For more facts Circle 622 on Reader Service Card



1. **Power up and power down** for constant power load control. Operates hydraulically, completely eliminates load springs.
2. **Convenient control handle**—forward, reverse; up, down. Two speeds standard, three speeds available.
3. Seven-inch **lifetime brake** of internal expanding, automotive type, for smooth, positive stops.
4. **Compact gear drive** construction, with motor, transmission and drive wheel mounted in a balanced, vertical column. Drive motor remains stationary.
5. **Electrical system** features extreme ease of accessibility. Fixed power leads eliminate high-current collector rings and flexible straps.
6. Totally enclosed nickel alloy **steel gears** revolve in constant oil bath for trouble-free service.
7. **Automotive, cantilever-type drive wheel** mountings—wheel may be removed with truck in normal operating position, without dismantling any part of transmission.
8. Excellent **maneuverability,** with compact design and short-coupled wheel base.



9. **"Flying Saucer" pallet wheels** position forks into pallets with unequaled ease. Handle empty, unchamfered pallets as easy as loaded ones.
10. **Single-package hydraulic unit** encases motor, pump, operating valves and reservoir into one contact assembly. Built-in strainer keeps out dirt.

Take it apart...see why this new Palletox "ticks" so well

Here's the first really new concept in walkie pallet trucks in years—Barrett's electric Lo-Lift Model PXG. Look at it carefully—inside and out. Then you see why your best buy is Barrett.

BARRETT-CRAVENS COMPANY
630 Dundee Road • Northbrook, Illinois

Representatives in All Principal Cities
Canadian Licensee: S. A. Armstrong, Ltd., Toronto, Canada

Barrett Handling Equipment

BARRETT

MATERIALS HANDLING ENGINEERS FOR HALF A CENTURY

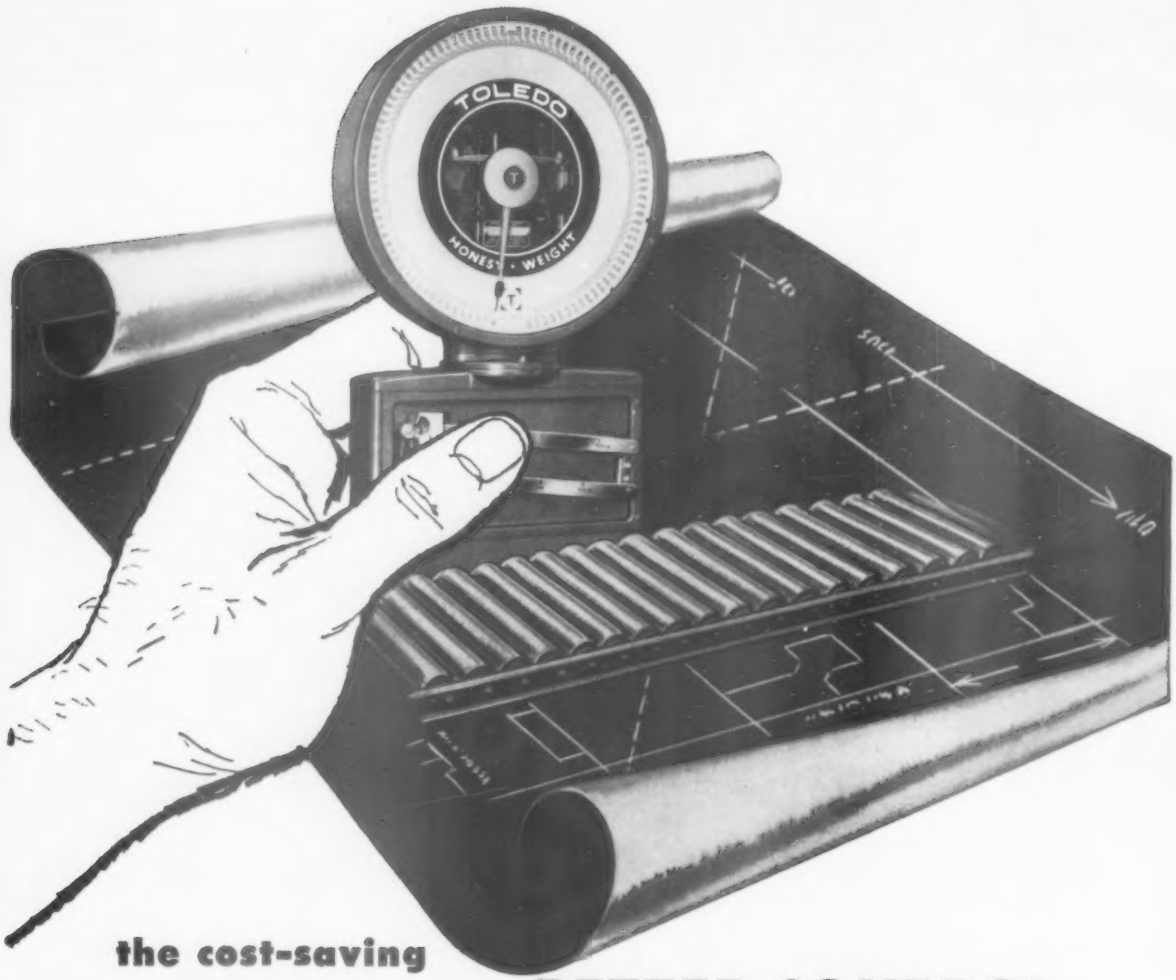
For more facts Circle 623 on Reader Service Card

For *all* the details, send handy coupon for new Model PXG Palletox Bulletin.

Barrett-Cravens Company
616 Dundee Road, Northbrook, Illinois

☐ Please send me Model PXG Palletox Bulletin
☐ Please arrange a showing of the new motion picture, "New Horizons in Material Handling"

Name ..... Title .....
Company .....
Address .....
City ..... Zone ..... State .....



the cost-saving trend today puts BETTER CONTROL where it counts most!

NEW TOLEDO PRINTWEIGH "400"

. . . complete printed weight records at your fingertips!

- Prints where you wish on full 8½" x 11" forms, or on tickets; also on strips.
- Prints full figures, even when unit weights are used.
- 6 to 12 bank selective numbering, or up to 10 weight symbol keys available for weight identification. Consecutive numbering.
- Date and time may be printed automatically.
- Transmits weight data for recording by remotely located office machines, if desired.

Ask for Bulletin 2017

On industry's scales, materials become money. Weight records directly affect costs, quality, inventories and customer billing. That's why it is so vitally important to put *Toledos* at all weighing points . . . where control counts most!

Major advantages that are yours with Toledos are being proven daily in plants of every size. Toledos provide more complete cost data . . . greater selection of models . . . savings in time and materials . . . welcome new simplification of records and record keeping. You can even carry Toledo accuracy directly into your accounting and inventory records, through weights printed at the scale, or transmitted on "electronic wings" for remote recording.

There are specialized Toledo units, too, for classifying, testing, counting, automatic batching and bulk weight control. So, whatever your weighing need, you need Toledos. To help you evaluate weighing efficiency in your plant, send for the Toledo weighing analysis kit. No obligation. TOLEDO SCALE, Division of Toledo Scale Corporation, Toledo 12, Ohio.

SERVICE
Factory-Trained
240 Cities

TOLEDO®

Greatest Name in Weighing

For more facts Circle 624 on Reader Service Card

For a gentle chime . . . a blasting horn . . . or a complete audio-visual system

IN COMMUNICATIONS SEE *Sperti Faraday*

Sperti-Faraday installations include Rockefeller Center, Waldorf-Astoria Hotel, Hotel Astor, Hotel Lexington, Walter Reed Hospital, Johns Hopkins Hospital and many others.

Whatever your problem, simple or complex, our engineers assist in designing the system that best suits your needs. Simply call your nearest Sperti Faraday representative or write Sperti Faraday, Inc., Adrian, Michigan. *In Canada*, write Sperti Faraday, Ltd., Montreal.

Specialists in: FIRE ALARM SYSTEMS • COMPLETE CLOCK SYSTEMS • HOSPITAL SYSTEMS • PATIENT OBSERVATION (CLOSED CIRCUIT TV) • AUDIBLE SIGNALS • ANNUNCIATORS • CODED PAGING SYSTEM • SYNCHRONOUS CLOCKS • TRANSFORMERS • CONTACT DEVICES

VIBRATING BELLS
Cat. No. 2000

VISACALL
Closed Circuit TV For Supervision of Hospital Patients Visacall-6

AC UNI-PACT HORNS
Cat. No. 121-U Megaphone Projector

KODE MASTER
Page-Boy of your Organization
Cat. No. 805

Sperti Faraday Inc.

ADRIAN, MICHIGAN

SINCE 1875 DESIGNERS AND PRODUCERS OF VISUAL AND AUDIBLE SIGNALS

at

Contractor: Roland Thompkins & Son, Inc. Hawthorne, N.Y.

Consulting Engineer: Giffels & Vallet, Inc. Detroit, Mich.

Architect: L. Rossetti Detroit, Mich.

—the Comfort Computation

came out . . .

DUNHAM-BUSH

The Dunham-Bush 'HAH' is designed for ceiling installation which conserves space vitally needed for engineering purposes.

Of course, IBM really didn't employ any of its masterfully precise computers to predetermine whose air conditioning equipment would best serve their new Engineering Laboratory at Kingston, New York.

But all equipment selected was calculated to meet the important demands modern industry must make to ensure personnel comfort and equipment protection.

For example, here at Kingston, 92 engineered Dunham-Bush Horizontal Air Handling units efficiently deliver conditioned air to create the climatic interior that's seasonally required. Dunham-Bush units have operational versatility that enables them to cool, heat, filter, or dehumidify air, according to temperature requirements. Additionally, such Dunham-Bush heating products as finned tube radiation with expanded metal covers, horizontal and cabinet type unit heaters, and F&T traps and strainers are used throughout the laboratory.

Contact your nearest Dunham-Bush sales representative for assistance when your next heating or cooling job arises.

You'll find that this one source—one responsibility is of inestimable value.

Close-up of Dunham-Bush 'HAH' which cools, heats, filters, dehumidifies air.

Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

WEST HARTFORD, CONNECTICUT • MICHIGAN CITY, INDIANA
MARSHALLTOWN, IOWA • RIVERSIDE, CALIFORNIA
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DUNHAM-BUSH DUNHAM-BUSH, LTD. LONDON, ENGLAND BRUMMER BRUMMER CORPORATION (CANADA) LTD. PORT HOPE, ONTARIO

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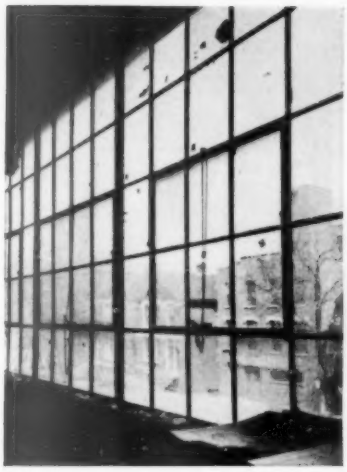

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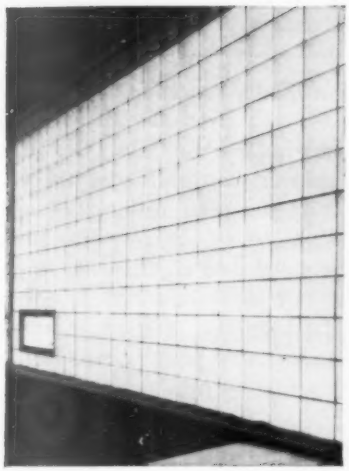


SOLVED–FOUR MAJOR WINDOW PROBLEMS

Are your window areas an eyesore? Do they leak dust and dirt; let in too much summer heat; drain heating system efficiency in winter? Do they create glare that cause workers discomfort and inefficiency? Does constant window maintenance put a dent in your budget?

Bermingham and Prosser Company, Chicago paper merchants, faced those four window problems when they converted a 141,000 sq. ft. grocery warehouse to their own paper storage and distribution operations. Vice President E. L. Todd reports: "We solved all our window problems by installing attractive panels of PC Suntrol® Glass Blocks."

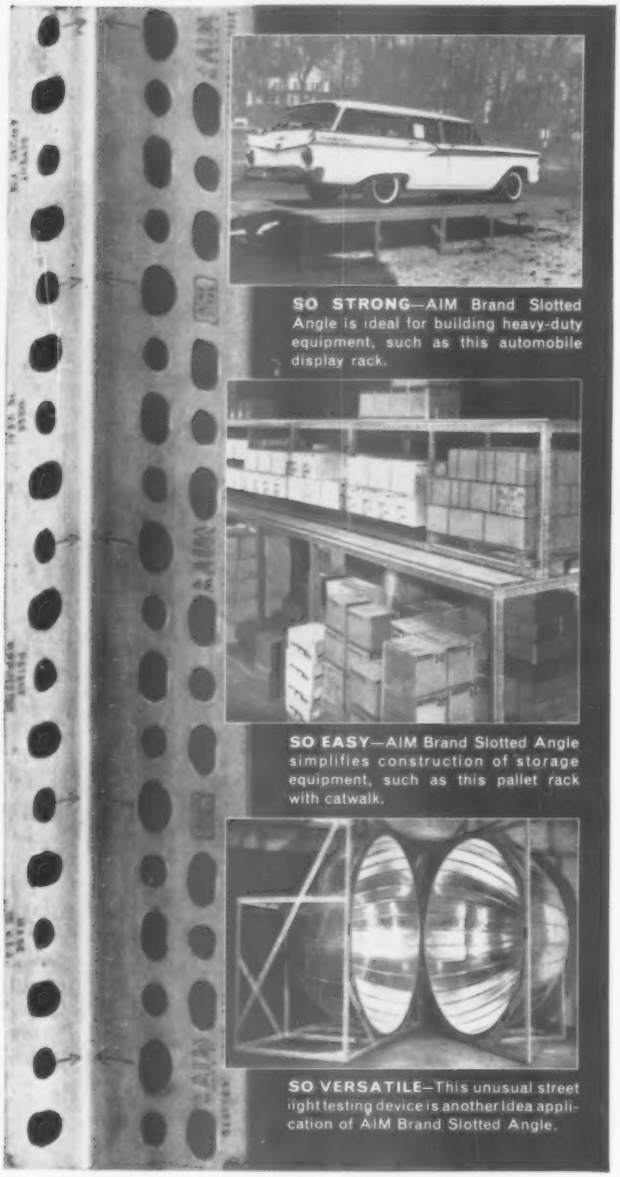
Mr. Todd continues, "The clean, handsome panels made a vast improvement in the appearance of our building. Dust and dirt can't get through. The light diffusing action of the blocks eliminates harsh daylight glare. And the hollow construction of each block gives us good insulating efficiency.

"Expensive maintenance is a thing of the past. No more rusted out sash to be replaced. No more window pane breakage. No more constant window washing."

Solve *your* window area problems with PC Glass Blocks. Get full details in our new General Catalog. It discusses our standard line of Glass Blocks, and the new size unit—the 4 x 12. Get your copy by writing Pittsburgh Corning Corporation, Department N-29, One Gateway Center, Pittsburgh 22, Pennsylvania. In Canada: 3333 Cavendish Boulevard, Montreal, P. Q.

PITTSBURGH PC CORNING

whatever your ideas suggest– build it with NEW AIM BRAND SLOTTED ANGLE



SO STRONG—AIM Brand Slotted Angle is ideal for building heavy-duty equipment, such as this automobile display rack.

SO EASY—AIM Brand Slotted Angle simplifies construction of storage equipment, such as this pallet rack with catwalk.

SO VERSATILE—This unusual street light testing device is another idea application of AIM Brand Slotted Angle.

There's practically no limit to what you can build with new AIM Brand Slotted Angle—the only framing material that gives you Lock-Joints, Friction-Joints and ⅜″ structural bolts.

The new, scientifically-spaced, slot-and-hole bolting pattern lets you meet all your building equipment needs with less manhours, less material and with greater structural strength. For normal construction and good rigidity, Friction-Joints are formed by bolting through the slots. For maximum strength and rigidity, ⅜″ structural bolts with full load shoulders fit round holes to form Lock-Joints. Each bolt has a safe load capacity of 2000 pounds, and can be applied with an ordinary or a power wrench.

As your needs change, AIM Brand Slotted Angle can be dismantled to be re-used again and again. This versatile framing material is available in two sizes: Standard 225-80 (2¼″ x 1½″ x .080″) and Heavy-duty 300-104 (3″ x 1½″ x .104″). Packaged in 10 pieces of 10 or 12-foot lengths with nuts and bolts.

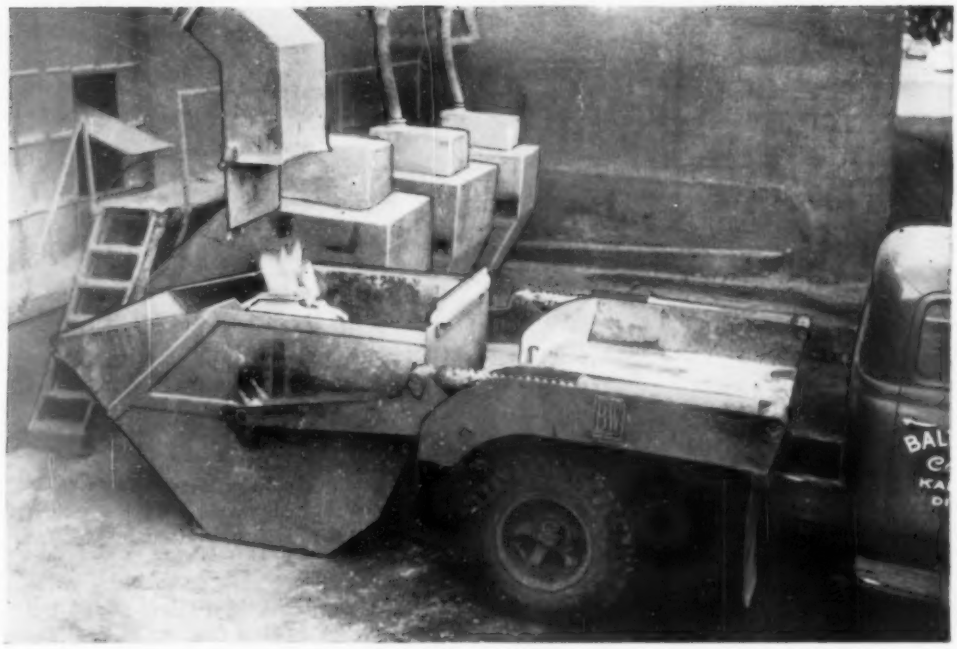
Cold-rolled galvanized steel, AIM Brand Slotted Angle is a product of Acme Steel Company, U. S. pioneers in slotted angle framing material. Available nationally through leading distributors or write: Dept. FAD-29, Fabricated Materials Division, Acme Steel Company, 135th Street and Perry Avenue, Chicago 27, Illinois.

ACME STEEL

AIM Brand Slotted Angle

AIM BRAND

For more facts Circle 628 on Reader Service Card



Big step forward in plant housekeeping

Load Lugger System solves difficult waste disposal problem for ceiling tile manufacturer

By tying the Load Lugger System of detachable containers in with a pneumatic dust and waste collection system, Baldwin-Hill Company's Kalamazoo plant has solved the problem of keeping plant and premises neat and clean, free of dust, chips and rejects generated along the production line.

Five Load Lugger containers receive the debris through hoses and chutes. In a single 8-hour shift, a single Load Lugger equipped truck and its driver dispose of all waste accumulated during two 8-hour production shifts. Periodic production shut-downs for "clean-up" have been eliminated. Production and quality is now maintained at a high level.

This installation typifies how the Load Lugger System contributes to more efficient plant operation, cleanliness and safety. **You'll want the complete story**—it may suggest ways in which the flexible Load Lugger System can increase housekeeping efficiency for **your** plant.

INGERSOLL KALAMAZOO ® B-W BORG-WARNER

Borg-Warner® Corporation

INGERSOLL KALAMAZOO DIVISION

1822 North Pitcher Street, Kalamazoo, Michigan, Telephone Fireside 5-3501

EXPORT SALES: BORG-WARNER INTERNATIONAL CORPORATION CHICAGO

SEND FOR THE BALDWIN-HILL STORY **TODAY**.

For more facts Circle 629 on Reader Service Card

New Invention Picks Up 40 Cu. Yd. Detachable Containers . . . 15-Ton Loads

Dinosaur picks up in excess of 30,000 pounds of granular material, white line inside container indicates load has not shifted.

DEMPSTER-DINOSAUR Combines Detachable Container Flexibility With Big Pay-Load Capacity

Unlimited Capacity

The proven savings of mechanically handled detachable containers have now been expanded to cover long, over-the-road hauls. Two DINOSAUR models are available for this work. One, for tandem trucks, handles 30,000 pounds; the other, for single axle trucks, handles 22,000 pounds. Special off-the-road models are available for loads limited only by the capacity of the truck.

For Docks and Flat Cars

Mechanically, the DEMPSTER-DINOSAUR is of extremely simple design. Components are a tipping frame, two hydraulic raise-and-lower cylinders and a double-acting cylinder which controls all container movements. No chains, sheaves or cables are used in its operation. It is the only over-the-road system that can push and pull containers on and off docks or railroad flat cars. This makes it possible to use the DINOSAUR in conjunction with "boxy-back" containerized cargo rail shipments.

The Dinosaur hydraulically pushes a container off on a dock and inside a building for unloading.

Many Sizes and Types of Containers are Available

DEMPSTER-DINOSAUR standard containers come in 21 sizes ranging from 14½ feet to 23½ feet in length and 10 to 41 cu. yd. capacity. Special cargo containers up to 35 feet, tank-type and stake side models are also available. Drop-down telescopic legs to hold container at dock height are optional on some cargo containers.

Free Booklet Offered

A free booklet which describes the operation of this new system in detail is offered by Dempster Brothers, the originator and only manufacturer of DEMPSTER-DUMPSTER Systems.

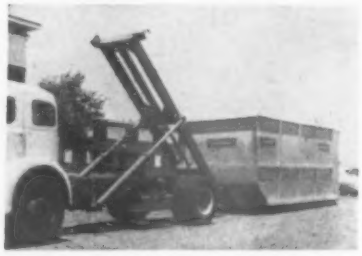
Mfd. By Patents Pending

DEMPSTER BROTHERS, Inc.

Dept. F-2, Knoxville 17, Tenn.

Containerized Cargo, Waste & Raw Materials Handled by DINOSAUR

The newly developed DEMPSTER-DINOSAUR is a system of materials handling that employs giant containers up to 40 cubic yards and larger. It lends itself to any situation where bulk accumulations of raw materials, liquids, waste or finished products must be handled. Since one truck and one driver can automatically pick up, haul and dump or set down a number of containers, the DINOSAUR easily does the work of several trucks.



Dinosaur backs up to loaded container and engages it with lifting bail.

Container is hydraulically pulled up inclined tilting frame.

Container is pulled forward where it automatically locks into carrying position.

NEW ARO "imp"

MODEL 7979, Actual Size

HIGH SPEED AIR GRINDER

GRINDS • DEBURRS • POLISHES • ENGRAVES

- No lubrication required . . . trouble-free performance.
- 75,000 R.P.M. turbine grinder . . . for finest grinding.
- Takes ⅛" shank-mounted wheels or cutters.
- Precision-made . . . compact, simplified design.
- Forward exhaust keeps work area clean.

SEE YOUR ARO DISTRIBUTOR FOR A DEMONSTRATION

complete kit
$54.50

ONLY $49.50

COMPLETE with ⅛" collet, 8' air hose and air line filter

THE ARO EQUIPMENT CORPORATION, Bryan, Ohio
Aro Equipment of Canada, Ltd., Toronto 15, Ont.
Offices in All Principal Cities

ARO® AIR TOOLS
Also Air Hoists . . . Automation Tools

For more facts Circle 631 on Reader Service Card

NEW

Clarke

POWER SWEEPERS

Model CS-36, available with riding sulky

do the work of up to 20 men —cut sweeping costs up to 80%!

Now Clarke adds power sweepers to its distinguished line of floor maintenance machines. And these new work-horses sweep cleaner, faster and more dust-free than any other sweeping method. They pick up all types of debris, cover up to 50,000 sq. ft. per hour, sweep right up to walls, maneuver easily in congested areas, drastically reduce man hours — and slash the cost of sweeping as much as 80%.

Advanced Clarke design offers a host of new efficiency features: **Unique forward-stop-reverse handle bar** eliminates shifting of gears, provides easy fingertip control. **Exclusive dust control system** protects premises and personnel. **Rotary broom control** adjusts for 23 broom positions, guarantees maximum broom life. **Rugged construction** assures years of dependable, time-and-money-saving service. Manufactured and guaranteed by Clarke, the best known name in floor machines.

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FLOOR MACHINE COMPANY

Formerly Clarke Sanding Machine Company

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THROUGH INCREASED PRODUCTION

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CORPORATION

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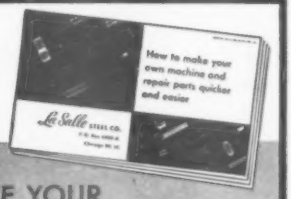

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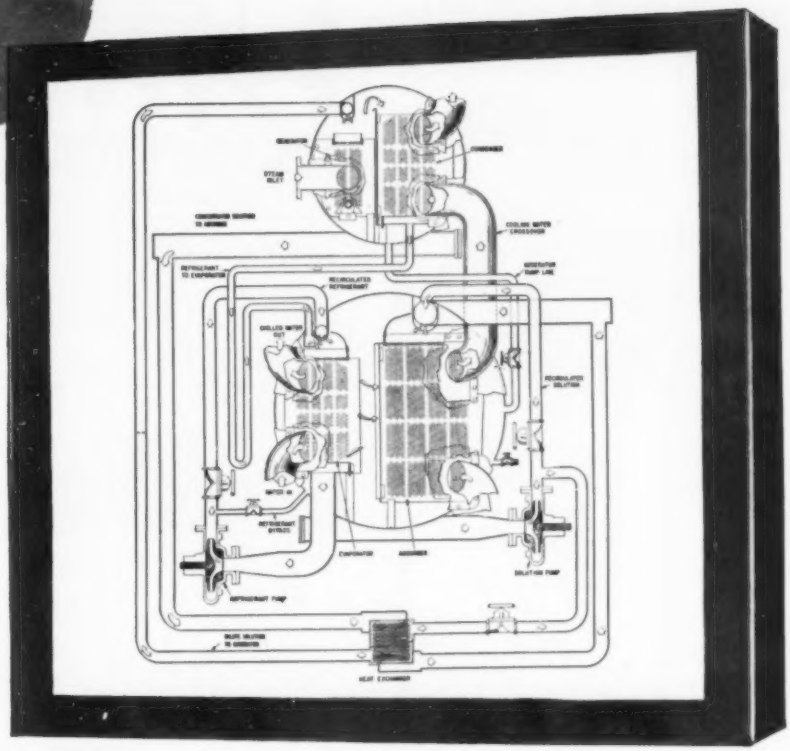

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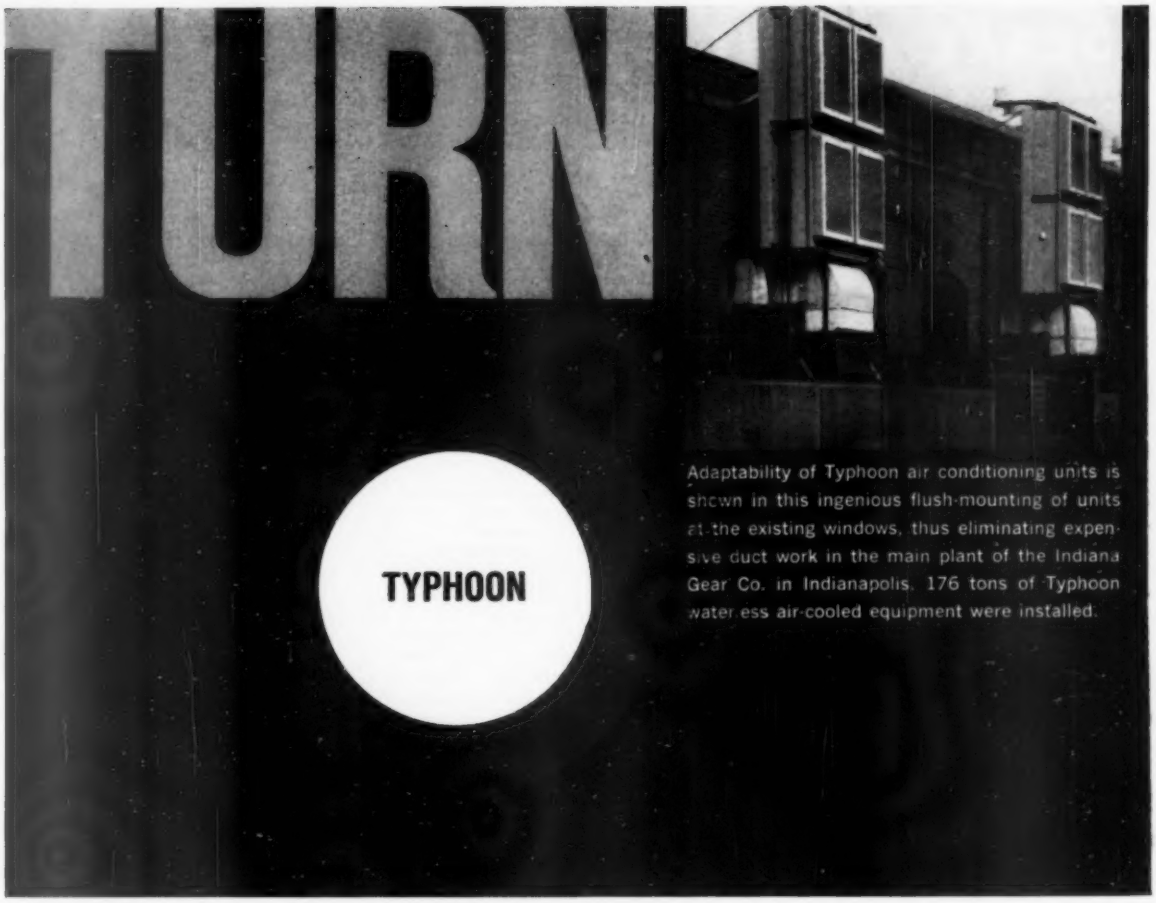
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Index To Advertisements

Abell-Howe Company 12
Acme Steel Company
Acme Steel Products Div. 96
Fabricated Materials Div. 258
Acme Visible Records, Inc. 163
Adams Company, Inc., R. P. 154
Aget Manufacturing Co. 188
Albertson & Co., Inc. 22, 23
Alemite Division,
Stewart-Warner Corporation 187
Alim Corporation 188
Allegheny Ludlum Steel Corp. 91
Allen-Bradley Company 225, 226
Allis-Chalmers Mfg. Co. .. 129, 130, 131
132, 197, 252
Alvey Ferguson Co. 177
American Metal Products Co. 105
American Monorail Company .. 184, 185
American Mutual Liability
Insurance Co. 180, 181
American Optical Co. 263
American Smelting & Refining Co. .. 109
Apex Machine & Tool Co. 104
Aro Equipment Corporation 261
Austin-Western Construction
Equipment Div., Baldwin-
Lima-Hamilton 148
Automatic Transportation Co. 24, 25
Azrock Floor Products Div.,
Uvalde Rock Asphalt Co. 49

Barrett-Cravens Company 253
Bassick Company 28
Bearings, Inc. 53
Black & Decker Mfg. Co. 135
Borroughs Mfg. Co. 158
Bostitch, Inc. 143
Brook Motor Co. 206
Buffalo Forge Company 108
Buffalo Pumps Div.,
Buffalo Forge Co. 35
Bulldog Electric Products Co. 235,
237, 239
Byers Company, A. M. 161, 162

Century Electric Co. 218, 219
Chisholm-Moore Hoist Division
Columbus McKinnon Chain Corp. 111
Chrysler Corporation, Airtemp Div. 231
Cities Service Oil Co. 137
Clark Equipment Company 189
Clarke Floor Machine Co. 262
Cleveland Tramrail Division
Cleveland Crane & Engineering Co. 139
Colonial Plastics Mfg. Co. 140
Colson Corporation 204
Commercial Filters Corporation 38
Conforming Matrix Corporation 262
Cushman Motor Works Inc. 245

Darnell Corporation, Ltd. 238
Dayton Rubber Company 101
Dazzo Products Inc. 249
Dempster Brothers, Inc. 260
DeVilbiss Company 6, 7
Dodge Manufacturing Corp. 49, 41
Dolge Company, C. B. 264
Dow-Corning Corporation 207,
208, 262
Dunham-Bush, Inc. 256

Eastman Kodak Company 223
Elwell-Parker Electric Co. 4
Eriez Mfg. Co. 136
Euclid Crane & Hoist Corp. 249
Exide Industrial Div., Electric
Storage Battery Co. 52

Factory 267, 268
Fafnir Bearing Co. 29
Fairbanks Company 8
Falk Corporation 93
Fastener Corporation 178
Federal-Mogul Service Div.,
Federal-Mogul-Bower
Bearings Inc. 210
Federal Pacific Electric Co. 213
Felters Company 138
Finnell System, Inc. 183
Formsprag Company 32, 33

Gardner Denver Company 153
Gates Rubber Company 14
General Blower Company 250
General Electric Company
Apparatus Dept. 111
Lamp Dept. 156
Goodrich Company, B. F. 1
Goodrich Tire Company, B. F.,
Div. of The B. F. Goodrich Co. 11
Goodyear Tire & Rubber Co. 5
Gould-National Batteries, Inc. 251
Graphic Systems 238
Gulf Oil Corporation 50, 51

Hall Laboratories, Division of
Hagan Chemicals & Controls, Inc. 229
Hancock Industries Inc. 166, 167
Hinde & Dauch, Division of West
Virginia Pulp & Paper Co. 59
Hough Co., Frank G. 157

Ingersoll Kalamazoo Division,
Borg-Warner Corp. 259
Irving Subway Grating Co., Inc. 246

Jenkins Brothers 15
Joy Manufacturing Co. 133

Kex National Service 10
Koppers Company,
Wood Preserving Div. 244

LaSalle Steel Company 264
Link-Belt Company 19, 103, 191
Logan Company 174
Lubriplate Div.,
Fiske Bros. Refining Co. 154
Ludlow Papers Inc. 201
Lunkenheimer Corporation Second Cover
Lyon Metal Products Inc. 26, 27

Magnaflux Corporation 186
Mahon Company, R. C. 18
Manhattan Rubber Division,
Raybestos-Manhattan, Inc. 46, 47
Master Lock Company 266
Masury-Young Company 214
McGraw-Hill Book Company 230
M-H Standard Corp. 266
Minnesota Mining & Mfg. Co. 247
Monarch Rubber Company 274
Multi-Clean Products Inc. 209

National Supply Company 34
Niagara Blower Company 244
North American Equipment Corp. .. 206

Pangborn Corporation 205
Parker Sweeper Company 264
Pennsylvania Flexible
Metallic Tubing Co., Inc. 248
Philco, Government &
Industrial Div. 16
Pittsburgh Corning Corp. 257
Pittsburgh Plate Glass Co.
Fiber Glass Division 217
Paint Division 17
Plastics & Coal Chemical Div.,
Allied Chemical 241
Platecoil Division,
Tranter Manufacturing Co. .. 171, 172

Radio Corporation of America 216
Ransburg Electro-Coating Corp. 234
Ready-Power Co. 224
Reliance Electric &
Engineering Co. ..... Fourth Cover
Remington Arms Company, Inc. 230
Republic Steel Corporation 30, 31
Revolvator Company 150
Reznor Manufacturing Co. 245
Ridge Tool Company 160
RLM Standards Institute 13
Roebling's Sons Corp., John A. 48
Rogers Brothers Corp. 186
Rol-A-Chart Div.,
Conley, Baltzer & Steward 222
Roura Iron Works, Inc. 1 0
Royal McBee Corporation 42
Rust-Oleum Corporation 36, 37
Ryerson Son, Inc., Joseph T. 54

Schrader's Son, A.
Div. of Scovill Mfg. Co., Inc. 242
Scott Paper Company 175
Seiberling Latex Products 245
Sheraton Hotels 215
Signode Steel Strapping Co. 110
SKF Industries Inc. 60
Sly Manufacturing Co., W. W. 102
Smith Corporation, A. O. 44, 45
Speedi-Dri Division, Minerals &
Chemicals Corp. of America 159
Sperti-Faraday, Inc. 255
Square D Company .... 155, Third Cover
Standard Conveyor Company 100
Standard Dry Wall Products Inc. 236
Standard Oil Company 149
Standard Screw Company 173
State of Minnesota 222
Stearns Electric Corporation 249
Steiner Company 240
Stromberg-Carlson Division
General Dynamics Corp. 272
Sudbury Laboratory 43
Sun Oil Company 89
Supreme Products Corporation 176
Swift & Company 227
Sylvania Electric Products Inc. 198, 199

Tennant Company, G. H. 243
Texas Company 20, 21, 95, 203
Thomson-National Press Co. 250
Toledo Scale Corporation 254
Tomkins-Johnson Co. 112
Towmotor Corporation 9
Trane Company 106, 107
Truscon Laboratories 151
Typhoon Air Conditioning Co. 269

Union Bag-Camp Paper Corp. 196
Union Wire Rope Corporation 190
United Specialties, Inc. 178
Up-Right Scaffolds 152
U.S. Rubber Company 39
U.S. Steel Corporation 194

Valdura Paint Division,
American Marietta Co. 134
Valley Electric Corporation 238

Wear-Ever Aluminum Inc. 179
Weber Marking Systems Div.,
Weber Addressing Machine
Co., Inc. 195
West Chemical Products, Inc. 97
Wiegand Company, Edwin L. 98, 99

Yale & Towne Mfg. Co. 141, 142
York Corporation, Subsidiary of
Borg-Warner Corp. 265

■

Industrial Consultants 248

■

SEARCHLIGHT SECTION
(Classified Advertising)
F. J. Eberle, Business Mgr.

■

Employment Opportunities 270
Special Services 270
Educational Books 270
EQUIPMENT
(Used or Surplus New) For Sale .. 270

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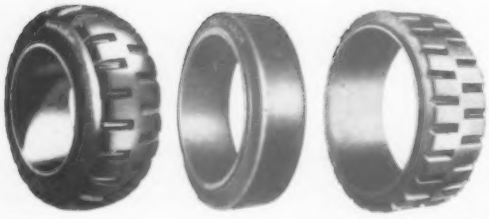

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CATALOGS — 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86
87 88 89 90 91 92 93 94 95 96 97 98 99 100

EQUIPMENT — 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119
120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141
142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163
164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185
186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207
208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229
230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250

MATERIALS — 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290

IDEAS OF THE MONTH — 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307
308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329
330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345

ADVERTISERS' LITERATURE — 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361
362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383
384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405
406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427
428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445

ADVERTISEMENTS — 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463
464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485
486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507
508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529
530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551
552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573
574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617
618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639
640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661
662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683
684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705
706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727
728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749
750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771
772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793

FEBRUARY 1959 —2

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CATALOGS — 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86
87 88 89 90 91 92 93 94 95 96 97 98 99 100

EQUIPMENT — 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119
120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141
142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163
164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185
186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207
208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229
230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250

MATERIALS — 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290

IDEAS OF THE MONTH — 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307
308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329
330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345

ADVERTISERS' LITERATURE — 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361
362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383
384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405
406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427
428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445

ADVERTISEMENTS — 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463
464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485
486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507
508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529
530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551
552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573
574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617
618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639
640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661
662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683
684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705
706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727
728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749
750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771
772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793

FEBRUARY 1959 —1

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Catalogs in This Issue

To help you, here is a list of catalogs described in this issue. To obtain, circle key numbers on either postcard.

PRODUCTION

1—Web Processing Machinery
2—Turret Lathes
3—Pneumatic Production Tools
4—Spray Decorating Equipment
5—Surface Grinding Machines
6—Horizontal Grate Cooler
7—Hole Gage, Setting Fixtures
8—Batching Systems
9—Mounted Wheels
10—Presses

INSTRUMENTS, CONTROLS

11—Digital Demand Recorder
12—Optical Equipment
13—Centralized Control Systems
14—Panel Control Systems
15—Temperature Indicator Monitor
16—Gages
17—Batch-Mixing Control Panel
18—Pressure Gages

MATERIALS HANDLING

19—Casters
20—Cranes
21—Oscillating Conveyors
22—Roller and Wheel Conveyors
23—Casters and Wheels
24—Parts Feeders
25—Sling Chains

AUXILIARY

26—Motor Pumps
27—Water Chillers
28—Water Heating Convertors
29—Dust Collector
30—Blowers and Pumps
31—Compressed Air Filters
32—Draft Gages
33—Air Conditioning
34—Heating, Ventilating Units
35—Panel Filters
36—Pumps
37—Fuel Burning Systems

ELECTRICAL

38—Rectifier Equipment
39—Heavy-Duty Limit Switches
40—Underfloor Raceways
41—Metalclad Switchgear
42—Pancake Motor
43—Automatic Tension Control
44—Motor Generator Sets
45—A-C Generators

BUILDINGS AND EQUIPMENT

46—Power Groove Lighting
47—Sub-Floor Panels
48—Tank Insulation
49—Drainage Products
50—Locks
51—Ceiling Lighting Systems
52—Wrought Iron Pipe
53—Lighting Fixtures

MECHANICAL

54—Speed Reducers
55—Air Motors
56—Drive Belts
57—Mechanical Seals
58—Variable Speed Drives

MISCELLANEOUS

59—Water Coolers
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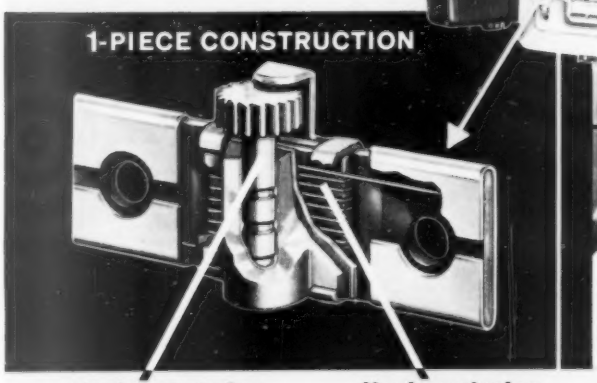

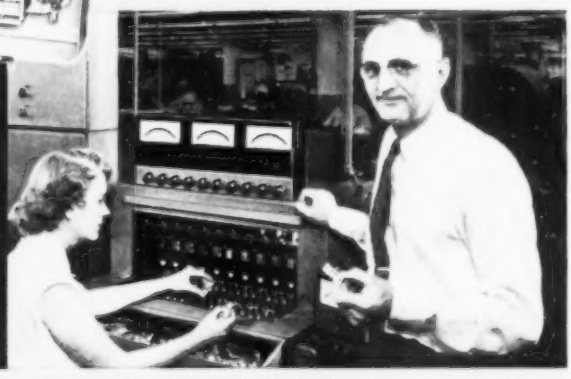

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